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Birmingham Again.

IT is not too soon for us to urge every manufacturer engaged in the production of British electrical goods to send in his application for space at the British Industries Fair to be held at Birmingham from February 21st to March 4th, 1927.

The success that attended the excellent display there early in the present year is common knowledge. It was among the best features of the Birmingham Section of the Fair, was a thoroughly businesslike undertaking, and placed British electrical trade in its proper place among the classes of products selected as appropriate to that important manufacturing centre. Through our own and other journals it has been made known to electrical buyers all over the world that what was then so well begun is to be continued on a larger scale next year. To all such in any part of the world where these notes are read we offer this reminder of that fact so that they may at once make arrangements to come to Birmingham and London in February, or if they cannot come personally, to ensure that their representatives stationed here shall visit the show armed with inquiries and orders to fill their requirements. We have used the word *fact* in the preceding sentence, notwithstanding that we write in anticipation of the event, for few things are more certain than that the 1927 Electrical Trade Market will be a credit to our industry.

In the short time that was available last year, between seventy and eighty manufacturers made a really live demonstration. Already, nearly two months earlier than active space-letting began last year, seventy firms, including our largest companies, have booked their space, and within the next few weeks the demands for the additional space that has been made available for electrical stands will give extra assurance that our industry is very much alive and is proud to show what it has to offer to the world.

The committee which managed matters so admirably last time has this year been strengthened by the addition of a number of other gentlemen representative of organisations or interests connected with the electrical and allied industries. While it necessarily happens that the heavy work of organisation and management will fall upon a few executive hands, the knowledge that these other associations have promised their co-operation is a most gratifying circumstance and will go far to secure a record result. It is a tribute to the excellence of last year's effort, and at the same time it announces

to the world at large that Colonial, foreign, and Home buyers will once a year find prepared for them in England a really representative market of British-made electrical apparatus, material, and equipment.

A small conference was held at the Birmingham Chamber of Commerce last week at which preliminary committee arrangements were announced. We report the proceedings on another page. We hope shortly to be in a position to announce the full list of those who have already booked their spaces. These all know that they are pledged to a short, sharp, market engagement. The object of our present preliminary references to the matter is two-fold—first to remind buyers of what is being done. But second, and even more pressing at the moment, it is to ask producers who have not already filed their applications, to look seriously into the matter at once and find the spot in the enlarged hall where they intend to display their goods. Some firms were disappointed last February that they were not present because the organisation period was so limited; they regretted their absence as exhibitors when they paid personal visits. This year, they know in good time and can arrange to find their rightful place amongst the rest. The expenditure need not be great. A very small and inexpensive space for a display counter can be very effectively employed.

The world contains some individuals who are under the impression that we are "down and out" because of our prolonged industrial disputes. If there is any Section of British industry that can give the lie to false reports and a flat denial to wrong impressions it is the Electrical Section.

There are four months between now and then for the coal dispute to end and for all kinds of work now in arrears to be placed. Foreign and Home contracts that have been held up because of our troubles will be flowing on to our books again. The Electricity Bill will have become an Act, and the electrical industry will be meeting its new responsibilities. The Wiring of Britain Campaign will have reached its height. Domestic electrification will still be promoting new business—the tide is already coming in! With all such influences at work, what more propitious moment could there be for an impressive and representative demonstration at Birmingham?

Is London Awake?

We began this leaderette with the title, "Wake up London!" but we have altered it out of consideration for the feelings of those of the electrical fraternity numbered among the eight million population of this great area, who are not still rubbing their eyes and wondering what all the noise in the country is about. It would be useful if we could set all the sirens in the district going simultaneously to announce that the "Wiring the Homes of Britain" campaign is making excellent progress everywhere else. As we cannot do that, we will issue an urgent message through these pages to everybody electrical in the metropolitan area to join in the movement without further delay. Reading between the sentiments expressed at the first E.D.A. Salesmanship Conference, of which we give a report on another page, we formed the opinion that in London at any rate there are some who are listless or lethargic, deaf or asleep. Who are they? It can hardly be that any electricity supply man, electrical contractor, or even small retailer is unaware of the existence and objects of the movement, after all the publicity that it has received. The Campaign headquarters is working at high pressure, some enthusiastic people are showing posters, engaging in local advertising, and meeting promptly the demand of the public for the Competition booklet (in some cases immediate business in the form of actual sales of electrical appliances to such applicants has resulted), but London is a big place, the most difficult of all areas to organise and run co-operatively. Yet how great are the potentialities! We appeal to everybody electrical in London to join forthwith in the Big Push.

Conditions in Japan.

The past two years have been devoted by Japan to making good the damage wrought by the serious earthquakes of 1923. During the first part of the period the country was practically thrown open to foreign manufacturers of the plant necessary for reconstruction, but now, according to the recent report of our Commercial Secretary in Tokio (reviewed in this issue), a period of reaction has set in. This means that protection of home industry has recommenced in a greatly strengthened form. The change was very marked in the electrical machinery section of Japan's imports; the total value fell from 21 million yen in 1924 to 12 million yen in the following year. Some hope is held out to importers in the statement that developments by the electric power companies may be expected in the future, but in the same paragraph of the report it is said that domestic production is steadily increasing in quantity and quality.

The adoption of specific duties (*i.e.*, upon weights instead of values) is said to militate against the importation of the more solid British machinery. There are, however, still certain classes of machinery which Japan cannot produce and therefore does not tax so heavily, but these are not specified in the report.

A study of the report in conjunction with the trade statistics published in our issue of October 15th shows that there is still a market for British electrical goods, although American and German competition is very keen.

Domestic Electricity Supply.

The report of the Advisory Committee on Domestic Supplies of Electricity and Methods of Charge, appointed by the Electricity Commissioners no less than 18 months ago, with Mr. J. W. Beauchamp, M.I.E.E., as chairman, was published last week, and is abstracted elsewhere in this issue. It was worth waiting for. The Committee took a broad view of its terms of reference, and has drawn up a series of recommendations which we can heartily endorse.

In the forefront are put the removal of restrictions on the erection of overhead lines, facilities for obtaining wayleaves, and the fixing of standard rates for wayleaves—conditions which are essential to the speedy and economical supply of electricity in rural areas, which is one of the main objects of the Government scheme. Moreover, relief from the onerous privileges and requirements of the Post Office is advocated. If these proposals are adopted, the rate of progress will be greatly accelerated, capital outlay will be reduced, and wayleave negotiators will feel that life is worth living, after all. Relief is also sought from the excessive cost and tedious delay incurred in obtaining Special Orders for extensions of area under the existing procedure.

The multipart tariff for domestic supplies, involving the use of a single meter for all purposes, which we have repeatedly advocated, is strongly recommended, in conjunction with a high alternative flat rate. We look upon this system as a fundamental factor in the development of the domestic uses of electricity—pending the day when Dr. Ferranti's ideal flat rate of $\frac{1}{2}$d. per kWh can be realised.

On the subject of trading powers, the Committee delivers an uncompromising verdict: "full trading powers should be granted to the remainder of the local authority undertakers not at present possessing them." This fiat is supplemented by the advocacy of hire or hire-purchase systems and efficient maintenance service—which are second in importance only to the offer of a reasonable tariff.

The report as a whole is an admirable statement of the immediate needs of the industry; dealing as it does with the distribution side of the electrical business, it is of more practical value than that of the Weir Committee, which related only to the generating side in the comparatively distant future. We hope that it will be possible to incorporate some, at least, of the recommendations in the Electricity (Supply) Bill without waiting for further legislation—the electrical industry is sick of legislation already.

A Modern Radiological Department.

The Extensive Electro-Medical Equipment of the Edinburgh Royal Infirmary.

THE new Radiological Department of the Royal Infirmary at Edinburgh, which was formally opened on October 8th by the Duke of York,* is claimed to be the largest and most completely equipped institution of its kind in Europe; indeed, it is doubtful if its equal exists in any country. Moreover, it is also probably the only department of its kind which has been planned, built, and equipped from start to finish entirely for X-ray work and electro-medical treatment, which is the logical method of attaining the high degree of efficiency demanded in modern hospitals.

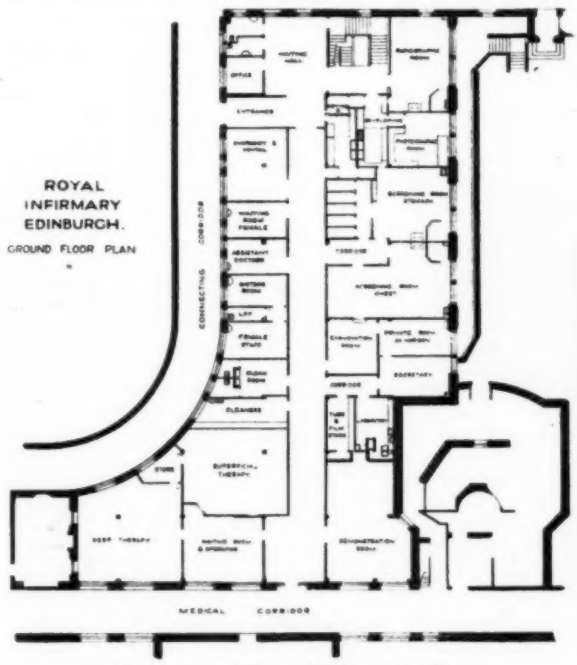


Fig. 1.—Ground Floor Plan, New Building.

The new building is 100 ft. long, with an average width of 60 ft., and consists of a basement and two floors; the structure has a steel framework throughout, with reinforced concrete floors and roof, the latter having been designed flat to support another floor, if necessary. The main walls have Craigmillar stone and precast concrete stone dressings, and adequate protection against X-ray radiation is afforded by the interior lining of the walls, which consists of barium slabs coated with barium plaster, the ceilings and floors having been similarly treated also.

Each floor is devoted to a different purpose; the basement houses all the machinery, large storerooms, and a mechanics' workshop. On the ground floor, fig. 1, are the various rooms of the radiological section, and on the first floor the electrical treatment and massage work are carried out.

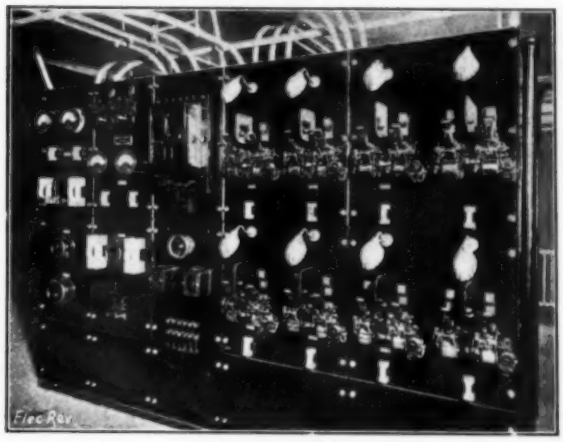


Fig. 3.—Switchboard, showing Tirrill Regulator.

The machine room, fig. 2, contains a G.E.C. motor-generator of 42 kW supplying 200-volt, 50-cycle alternating current for all purposes throughout the Department, a motor-generator of 1 kW supplying 80-volt d.c.

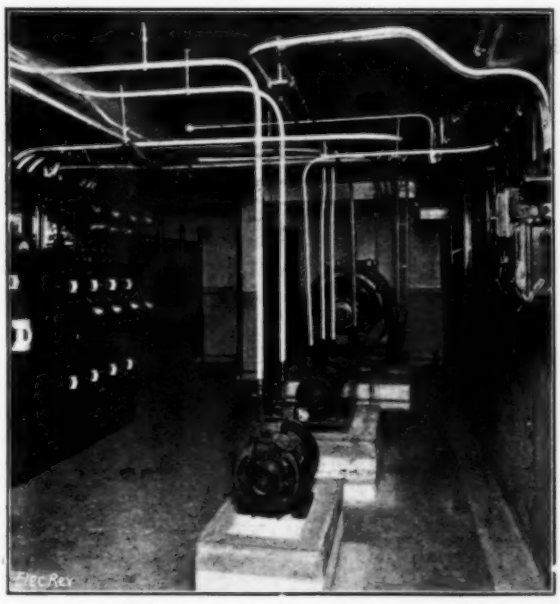


Fig. 2.—Motor-Generator Room, Basement.

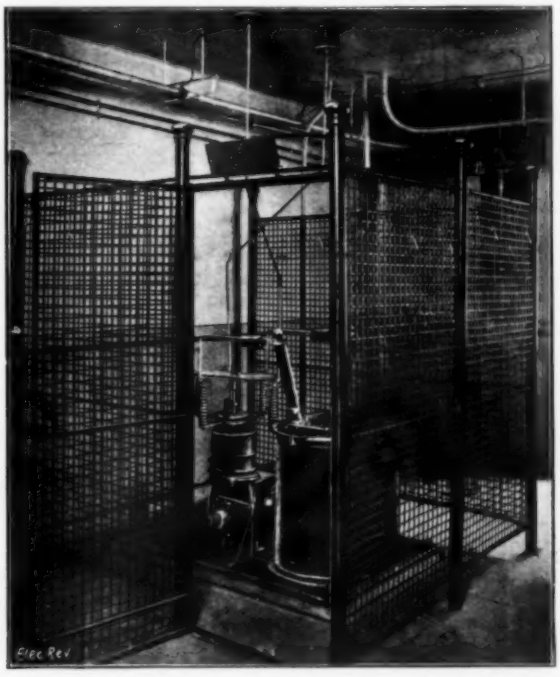


Fig. 4.—X-Ray Transformer and Rectifier, 10 mA at 150,000 V.

at constant potential at all loads for electrical treatment purposes, and a 3-kW rotary convertor operating on the 230-volt direct-current main supply; this latter machine

* See ELEC. REV., October 15th, 1926; p. 628.

is for use with an emergency outfit. All the G.E.C. switchgear for these machines is erected near to them,

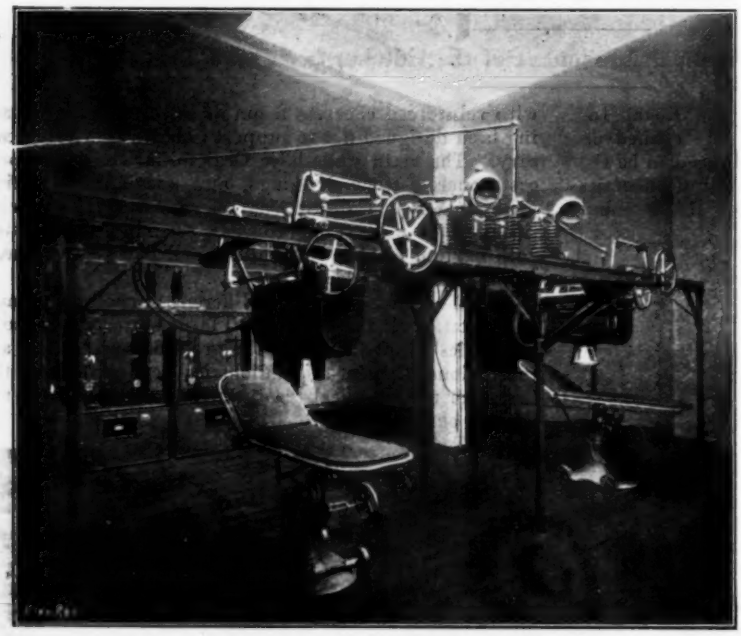


Fig. 5.—Deep Therapy Equipment, 10 mA at 250,000 V.

fig. 3, including an eight-way distributing panel, where the alternating current from the large motor generator is split up and conveyed by separately-protected circuits to the various pieces of apparatus. A special cable from the town's network supplies 460-volt direct current for driving the large motor-generator only; at its point of entry in the machine room it is split up by means of a large d.c. distributing panel so that 230-volt direct current is available for lighting and power purposes throughout the Department.

Three oil-immersed high-voltage transformers are also installed in the basement, or machine room, each being directly under an X-ray room on the ground floor; the high-voltage current is conducted through the ceilings into the rooms above by means of conductors passing through special porcelain insulators, fig. 4. Each transformer is capable of an output of 100 milliamperes at 150,000 volts (peak value), being controlled entirely from a trolley-type switch-table installed in each appropriate radiographic room on the ground floor. By this means the noise and vibration of the moving parts are kept out of the X-ray rooms, and work can be carried on in absolute silence. Each transformer and mechanical rectifier are enclosed in expanded metal cagework, fig. 4, on the outside of which is an illuminated sign which lights up immediately the operator in the room above starts the apparatus.

One special feature of the power installation is the B.T.-H. Tirrill voltage regulator, which operates in conjunction with the 42-kW motor generator and enables the voltage between no load and full load on the X-ray transformers (when all are being used at once) to be kept practically constant, any voltage variation due to load, or fluctuating supply pressure, being corrected and restored to normal within a fraction of a second. It has so often been the experience of operators of X-ray equipment that an unavoidable fluctuation of supply current results in inconsistency of radiographic results, that the question of voltage variation has become a very important one. It can, however, be satisfactorily dealt with as explained above.

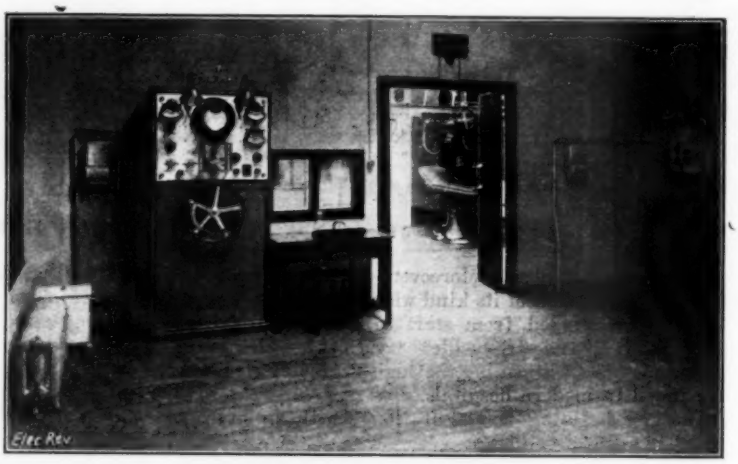


Fig. 6.—Deep and Superficial Therapy Control Room.

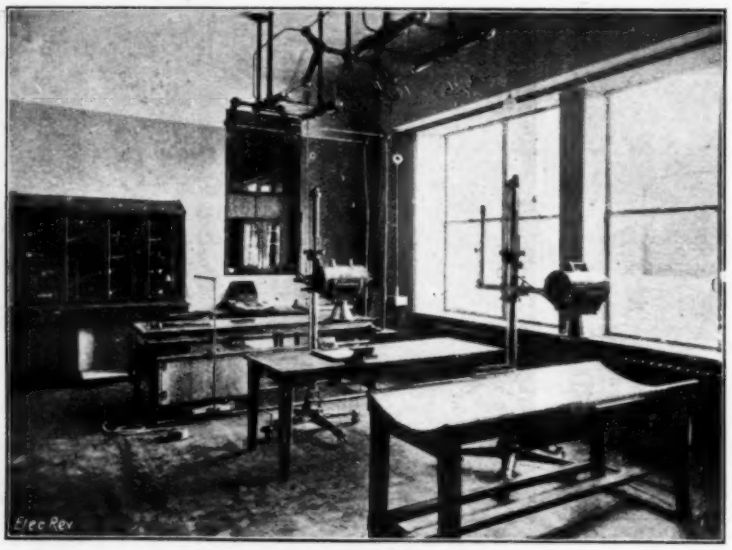


Fig. 7.—Radiographic Room No. 1, General.

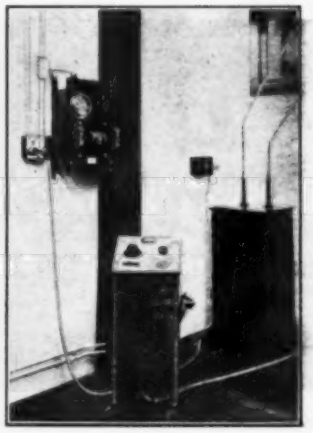
Three batteries of accumulators, giving 4 volts each and having a capacity of 60 ampere-hours, are accommodated in the basement, but apart from the machine room. While one battery is in immediate use, one is standing by ready charged, and the third one on charge; this low-voltage supply is led to the various pattresses distributed throughout the electrical treatment department, and the capacity of the accumulators allows for the use of cautery burners taking a current of up to 10 or 20 amperes, small examination lamps, or other electrical apparatus requiring a low voltage.

On the ground floor, fig. 1, the chief rooms are as follows:—Deep therapy treatment room, superficial therapy treatment room, three radiographic and fluoroscopic rooms, a lecture room, and another containing an emergency outfit. The patients are received at the office next to the entrance door, whence they go to the waiting halls at either end of the corridor; they then proceed as required to the dressing rooms before passing into the X-ray or treatment room itself.

The equipment in the deep therapy room is used chiefly for the treatment of malignant or cancerous growths, and is of a special type* employing high-potential transformers, condensers, and rectifying valves of the hot-cathode type, which are visible in the background of fig. 5. Two patients may be treated separately and at the same time with the one set of equipment, fig. 5, which is capable of a continuous current output at 250,000 volts of 10 milliamperes. The X-ray tubes are entirely surrounded by 5 millimetres of lead, except the small aperture through which the X-rays are emitted. In all the rooms in the Radiological Department the walls are lined with specially manufactured tongued and grooved barium blocks which afford protection against X-rays equal to that of 5 millimetres of lead. The switchgear, fig. 6, is located outside the treatment rooms, so that the operator works in complete safety from X-radiation. The doors are covered with 3 millimetres of lead, and special lead-glass windows through which the patients may be observed during treatment also provide the same degree of protection.

A smaller installation of the same type serves another room wherein such superficial work as ringworm treatment is undertaken; the output of this smaller continuous-current plant is half that of the larger one, namely, 10 milliamperes at 125,000 volts. A system of bells communicating with an indicator in the control room enables each patient to attract the attention of the operator, if necessary. In passing, it is interesting to note that an oscillograph record of the current curve of the above type of equipment resulted in an almost straight line, which means that the voltage generated is as near as possible direct, and, therefore, ideal for X-ray work.

Three separate rooms are used for radiographic and fluoroscopic purposes, each having its own high-potential transformer situated in the basement as mentioned previously. The first, fig. 7, is the radiographic room wherein the majority of the out-patients are dealt with. It contains a protective cubicle for the operator,



Figs. 8 and 9.—Radiographic Room No. 1; Operator's Cubicle and Control Gear.

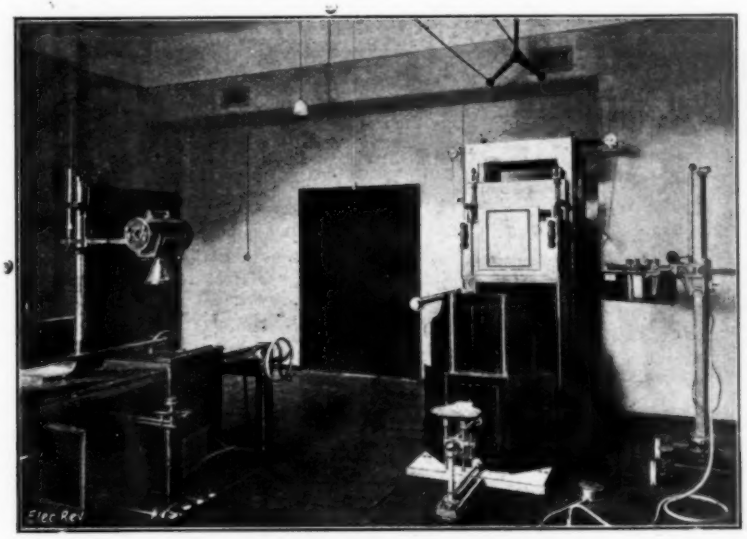


Fig. 10.—Radiographic Screening Room, Stomach Cases.

to be seen on the left of fig. 8, built of protective blocks such as have already been described, which houses the portable trolley switch-table, fig. 9, controlling the transformer in the basement. Special overhead corona-less high-voltage connections in the form of aluminium tube fixed to the ceiling convey the current from the point where the insulators emerge from the floor to the two tube stands and X-ray couch which the room contains. It is not necessary to make any alteration in high-voltage connections when changing from one piece of apparatus to another, all the operator has to do being to pull a cord, which changes over the connections automatically. The box containing the X-ray tube underneath in the case of the couch has lead protection equal to 3 millimetres of lead, and the tubes in

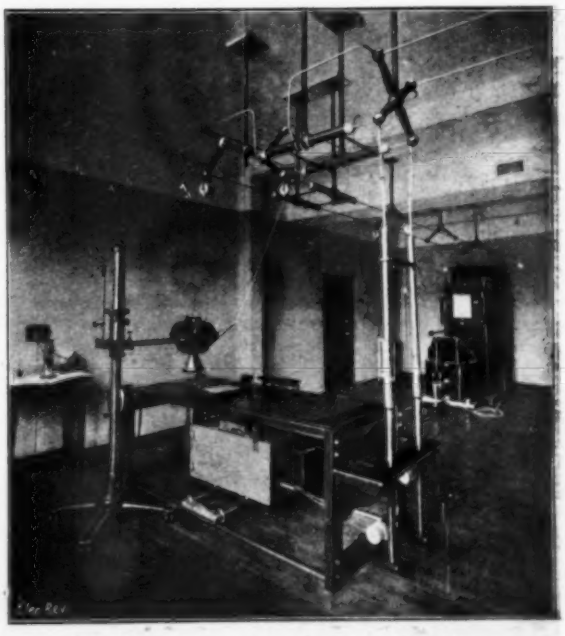


Fig. 11.—Radiographic Screening Room, Chest Cases.

the adjustable stands for over-couch work are also fully protected.

The second radiographic room, fig. 10, is reserved for

* See also Electrical Review, August 7th, 1925, p. 220.

stomach cases, and is equipped with a new type of screening stand, comprising three separate units, an X-ray couch, and a tube stand similar to that described

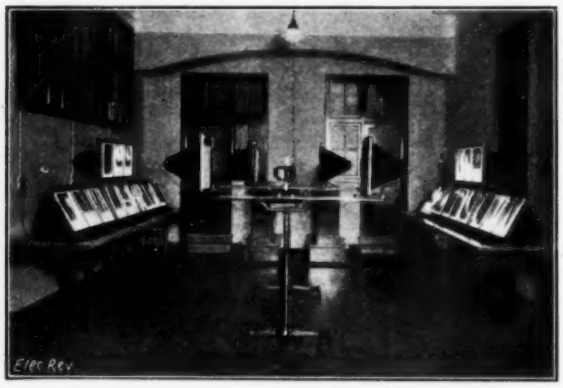


Fig. 12.—Demonstration Room, showing Viewing Boxes and Stereoscopes

previously. A feature of this room is a special piece of apparatus whereby a series of radiographs of the stomach may be taken very rapidly, the whole procedure being practically automatic. Each picture can, however, be seen on the fluorescent screen before the exposure is made.

The third room, fig. 11, is given over to the examination of chest cases, the equipment comprising a three-unit screening stand similar to that in the stomach room, an X-ray couch, a tube stand for over-couch work, and a special form of apparatus for investigating the movements of the heart radiographically. This last instrument embodies several improvements suggested by Doctor Robert Knox, who first constructed a machine of this type at the Cancer Hospital, London.

A complete X-ray unit is installed in the emergency room, which can be operated from its own rotary converter quite independently of the

Fig. 14.—Artificial Sunlight Arc Lamps.

42-kW motor-generator, and enables any case to be dealt with when the machine room has closed down for the day. The outfit is capable of carrying out all types of radiography, and is particularly simple to operate, thus being very suitable for use by any member of the Infirmary staff who may not be very familiar with X-ray work.

On the wall in this room is fixed a dental X-ray outfit of unusual design: an adjustable arm carries at its extremity all the necessary parts, consisting of a high-potential transformer, oil-immersed and capable of an output at 45,000 volts (r.m.s.) of 10 milliamperes; a current stabiliser, and an X-ray tube protected with a covering of lead glass. These items are all contained in a metal tank measuring $9 \times 7 \times 7$ inches, and there is absolutely no danger of either patient or operator receiving an electric shock of any sort, all dangerous parts being out of reach and immersed in oil, which feature is a great convenience for dental work wherein the tube is brought comparatively close to the patient.

A lecture room large enough to accommodate 40 students is equipped principally with a projection lantern, 24 illuminated viewing boxes for inspecting negatives, and two stereoscopes, fig. 12. Illuminated viewing boxes and a stereoscope also form part of the furniture in the radiologist's and his assistant's rooms, where the films exposed during the day may be inspected and reported upon.

Fig. 13.—Part of the Electrical Treatment Room.

All the developing and photographic work is carried out in the Department itself, a dark room on the ground floor having been equipped with the latest appliances to enable the large number of negatives exposed each day to be quickly dealt with; it is so situated that exposed films may be passed into it from the various radiographic rooms through light- and X-ray proof apertures, and new films taken from the dark room as required.

The first floor is occupied by the Electrical Treatment Department. With the exception of the equipment in the ultra-violet arc-light rooms, which requires a fairly heavy direct current, the apparatus on this floor consumes little current. It was, therefore, found possible to terminate all the various supply mains required on small pattress blocks distributed throughout all rooms, fig. 13. Each pattress consists of four non-interchangeable plugs with sockets, to each of which is led a different supply, *viz.*, 230-volt direct current from the town's mains, 200 volts at 50 cycles from the motor generator, 70-volt direct current from the small motor-generator, and 4 volts from accumulators. Each plug is so arranged that it is impossible to withdraw it unless the current is first switched off; in order to avoid any confusion, the plug socket has the nature of its supply engraved above it. By means of these pattresses the whole electrical wiring of the floor was very much simplified, and any piece of apparatus can be used whenever and wherever it is required.

One room is equipped with remedial exercise and gymnastic apparatus only. The natural lighting and ventilation of this room, in common with others throughout the Department, are particularly good, making the working conditions very pleasant. Ventilation is efficiently carried out by means of a system of air ducts and high-speed electric suction fans in the roof tower; extraction takes place at the ceiling level,

fresh-air inlets being provided in all rooms on the ground level. The building is heated, as is the whole Infirmary, on the vacuum steam radiator system.

Adjoining the gymnasium are two large rooms for male and female electrical treatment. Each is equipped with wall-type treatment boards from which various types of interrupted and galvanic currents can be obtained; it is these boards which are supplied by the 80-volt motor-generator in the basement. A Schnee bath with unbreakable receptacles for the arms and legs is installed in each room, together with many other modern appliances, including diathermy and high-frequency apparatus. Plain massage couches are placed round the walls of each room on which the patients recline while undergoing treatment.

At the extreme end of the corridor is a laboratory where any experimental, or research, work may be conducted.

It is useful to have a small room where any type of treatment can be given in cases requiring special attention, and with this idea in mind one room was equipped with a treatment board on the wall, diathermy apparatus with condensation couch, &c., while a smaller room contains mercury-vapour arc lamps for use for both general and local ltra-violet ray treatment. General irradiation by carbon-arc lamps (artificial sunlight treatment) has been provided for by equipping two rooms, one for male and one for female patients, with powerful hanging arc lamps, fig. 14, and also a portable type of arc lamp which is convenient for the treatment of patients who are unable to sit up. The control boards for these lamps are fixed to the walls of the rooms, but an emergency switch outside in the corridor will switch off both lamps if necessary.

The building was designed by Mr. T. W. Turnbull, Master-of-Works, and erected under his supervision.

Messrs. Watson & Sons (Electro-Medical), Ltd., were entrusted with the work of designing the Department from the electrical standpoint, and were responsible for the supply of the whole of the X-ray and electro-medical equipment.

Dr. Robert Knox acted as honorary expert adviser, and Dr. J. M. Woodburn Morison, M.D., is radiologist to the Infirmary. Modern ideas call for a very high standard of efficiency in X-ray work, and not only does this new Department, which has cost approximately £52,000, meet all reasonable requirements in this respect, but it also marks a very important step forward in the science of radiology.

Selling Electricity.—II.

Some Impressions of American Methods.

By R. HARDIE,
Glasgow Corporation Electricity Department.

The Domestic Cooker.

There were few indications of big business in this direction, *e.g.*, New York is content to leave the cooking load to the gas industry, whilst after a painstaking search through the largest electrical showrooms in the world (Chicago) one failed to unearth a single electric cooker, excepting small 600-watt units of the fireless cooker type. From an inspection of several factories it was evident that cookers were being manufactured and sold, but mainly, I should say, in areas where water power supplies were available, *e.g.*, the Niagara Falls zone, and in the Far West. Hiring of cookers, or in fact hiring of any class of apparatus, is unknown. Cookers are sold at list price, payments being spread over twelve to eighteen months. The cost of wiring is a charge against the consumer. Neither does one meet the hired-out gas cooker. Development in cooker design appears to be on similar lines to our own, *e.g.*, manufacturers are at present engaged on the perfecting of an enclosed type (trouble-proof) boiling plate. Cookers are mainly of the table type, with oven and boiling table side by side. Temperature control and clock mechanism are fitted on the majority of better-class ranges.

The N.E.L.A. Domestic Cooking and Water Heating Committee has been studying the range as a load and revenue producer. This study has culminated in the report this year of the Range Survey Sub-Committee. The decision is favourable. It has been determined definitely that the range load is good business for the power company which has a rate to support it.

"The electric range is one of the most practicable heavy current-consuming devices that can be sold to residential users. It returns a total revenue per dollar of investment which compares favourably with that derived from any other class of business. It returns a total revenue far greater than any of the other generally accepted domestic applications, including lighting.

"The range added to the average residential installation will increase the annual load factor to 20 per cent. from 12 per cent. It is a soundly developed device, and can be supported by the central-station company. It also paves the way for other heavy current-consuming appliances in the home."

Refrigeration.

Mention has been made of electric refrigerators, and to-day all over the United States supply companies are concentrating on the rapid acquisition of this business, with considerable success. Their point of view is well summarised in the undernoted report of the National Electric Light Association Committee:—

> "Domestic refrigeration is ideal, and if used in large numbers results in approximately 100 per cent. daily load factor on the system, and has an exceedingly high annual load factor. It tends to offset the season residential load due to reduced lighting in summer months, when maximum refrigeration is required.
>
> "Manufacturers are expecting to sell 400,000 new machines this year in the United States, returning £6 each to the central-station companies, or a total increase in revenue of £2,400,000, and practically without increase in investment on station plant and transmission."

The average consumption of a domestic refrigerator is:—

800 kilowatt-hours per annum, if at 1d. = £3 6s. 8d. revenue.

800 kilowatt-hours per annum, if at 1½d. = £5 revenue.

Quite desirable business!

Electric Fires.

While bowl fires are widely used for the occasional heating of the home at seasons of the year when the central heating plant is not in operation, the electric fire, of 2-kW or 3-kW loading, is rarely met with. In any case, with the lower temperatures prevailing over long periods of the year, the cost of residence heating by means of electric fires at the usual rates would be prohibitive, more particularly as the indoor temperature is usually kept at 70 deg. F. or higher.

Lamps Supplied Free.

Several large supply companies that were visited had a scheme of free lamp maintenance, the figures involved reaching large dimensions. The undernoted excerpts from a folder "Lamp Service" are of interest:—

"*First Supply of Lamps.*

> "The company will furnish one lamp for each lamp socket in the customer's connected installation, and will, at the customer's request, furnish an additional number equal to approximately 10 per cent. of the

total number of lamp sockets in such installation, such additional lamps to be used by the customer as a reserve supply for the renewal of worn-out or defective lamps.

"*Renewal of Lamps.*

"When any lamp shall have burned out and shall be returned to the company with glass intact, the company will furnish to the customer in exchange a new lamp in accordance with the schedule.

"*Delivery of Lamps.*

"On request by telephone or letter, lamps for exchange will be delivered to your home, store, or office without extra charge for delivery."

As will be seen, the service is complete. In addition to the lamp renewal counter at the head showroom, Chicago, where usually ten assistants are busily engaged handing out new lamps in exchange for old, there are fifteen lamp renewal stations throughout the various districts of the city where lamps may be exchanged. The number of lamps dealt with by Chicago under this heading last year amounted to 5¼ millions, while the figure in another city was two million lamps supplied free. Other districts had a correspondingly large turnover. An eight-page folder issued to consumers gives full particulars of the service and information regarding types of lamps exchanged. Sixty-watt vacuum lamps are supplied free. For lamps of smaller wattage there is a nominal charge:—

15 watts 8d.; 25 watts 6d.; 40 watts 4d.; 50 watts 2½d.

As one would expect, the bulk of the lamps installed are lamps of high wattage, which is obviously the intention of the supply company. Even larger lamps, gas-filled type, are supplied at nominal figures:—

750 watts 1s. 2d.; 1,000 watts, 1s.

Note.—A 1,000-watt, gasfilled lamp in Great Britain is sold at 20s.

It may be urged that the consumer pays for this service in an increased charge per kilowatt-hour, but if so, this is not reflected in prohibitive tariffs. I was assured that executives considered the policy of free lamp maintenance good business, and they proceeded regardless of the opinions or wishes of the trade. With it there is a guarantee that the lamps installed will be of the highest efficiency, and it certainly makes for a free and generous use of electricity for lighting, which is the true objective of all supply authorities. I am not here seeking to invoke the wrath of various branches of the industry by advocating the inauguration of similar schemes in this country, but am merely putting on record what is being done elsewhere.

Tariffs.

The schedule of rates of an American supply company is usually a bulky volume. One before me just now consists of 27 quarto sheets offering an infinite variety of rates to consumers—regular power service, large lighting and power service, limited-hours service, flat-rate lighting service, &c. In most districts the rates proposed by the central station for the ensuing year must be submitted in advance to the State Department of Public Utilities for approval, and consumers are thus safeguarded against extortionate rates. There did not appear, however, to be any desire or tendency on the part of central stations to bleed consumers.

An excerpt from the tariff of the Detroit Edison Company may be taken as typical of the reducing rates generally in force:—

"*Standard Lighting Rate Annual Contract.*

"For the first thirty hours' use per month of total maximum demand, 5d. per unit; for the next, one hundred and twenty (120) hours' use per month, 2d. per unit; for further use, 1d. per unit.

Note.—The consumer is not left guessing as to the meaning of "maximum demand." This and other terms of interest are explained in simple language in a small booklet issued to him.

"Minimum charge: For thirty hours' use of maximum demand per month at 5d. per unit, but not less than 6s.

"*Discount for prompt payment ten per cent.*"

An alternative for residences is offered, *viz.*:—

"6d. per kilowatt-hour for the first three kilowatt-hours per month per room in each residence, excluding kitchen, bathroom, three bedrooms, halls and basements, but in no case shall a residence be considered to have less than three rooms, *i.e.*, the kilowatt-hours per month chargeable at the 6d. rate shall not be less than nine, and for additional use 2d. per kilowatt-hour.

"Minimum bill: 2s. per month.

"*Discount for prompt payment ten per cent.*"

Boiled down, this is not so intricate as it appears at a first glance. In a residence with, say, three public rooms, three bedrooms, and usual offices, with an annual consumption of, say, 500 units (lighting and use of vacuum, iron, and sundry appliances) the bills would be:—

12 × 9 = 108 units at 6d.	£2	14	0
392 units at 2d.	3	5	4
Total for 12 months	£5	19	4
If the annual consumption is:			
750 units	£8	1	0
1,000 units	£10	2	8

At the Glasgow domestic rates the bills for a house of this size would be:—

Annual consumption of 500 units ... ... Units.			
250 at 4½d. ...	£4	13	9
250 at ¾d. ...	0	15	8
	£5	9	5
Annual consumption of 750 units ... ... Units.			
250 at 4½d. ...	£4	13	9
500 at ¾d. ...	£2	6	11
	£7	0	8

while with larger consumptions the Glasgow rates are increasingly in the consumer's favour.

Class Rate for Churches: 2½d. per unit less 5 per cent. prompt payment. This rate is optional for light and power service to churches, charitable institutions, societies, schools, municipal, State or Government institutions, and appears attractive at any rate for churches.

Rate for Theatres: 2½d. per unit, less 10 per cent. for prompt payment.

To sum up, their initial rates of 4d. to 6d. per kilowatt-hour appear to be in line with the rates obtaining in this country for maximum-demand quantities, but the number of kilowatt-hours to be taken before the lower rate is reached is very much higher (the terms quoted above are equivalent to 936 hours per annum use of the maximum demand at 5d., compared with the Glasgow figure of 730 hours at 4½d. per kilowatt-hour), while the secondary or rebate rate, when reached, is often higher than ours (in this case it is 1d. as against Glasgow's figure of ¾d.). So far as I can trace, they have nothing corresponding to British two-part tariffs, and one seldom meets with anything lower than 1½d. per kilowatt-hour. In effect, this means that the total bill for an equivalent number of hours' service is higher than with us. It would seem that American central stations are at present content to sell electricity for purposes where the advantages of convenience, utility, and low running cost put it easily beyond competition, *e.g.*, for lighting, iron, vacuum cleaner, clothes washer, coffee percolator or teapot, even a refrigerator, and to *avoid* business such as heating and cooking, to obtain which, in competition with gas, they would require to offer rates which they may consider uneconomic. If this view is correct, it may explain their inaction in certain directions. In Britain, *per contra*, we aim to get as high a price as possible for lighting and other services where gas is non-competitive, and having obtained the bulk of our standing charges from that source, we are in a position to offer a very low secondary rate to obtain the *large* consumption inseparable from the use of electric cookers and electric fires.

Imperial Wireless "Beam" Communication.

The Inauguration of the England-Canada Public Telegraph Service.

THE high-speed radio-telegraph service which was inaugurated at midnight on October 24th is the first in the world to be operated on the short-wave "beam" principle, and marks the completion of part of the scheme for linking Great Britain and her Dominions.

The English stations concerned are the transmitter, near Bodmin, Cornwall, which provides two beams, one for communication with Canada and the other for communication with South Africa; and the corresponding beam receiver, which is situated near Bridgwater, Somerset.

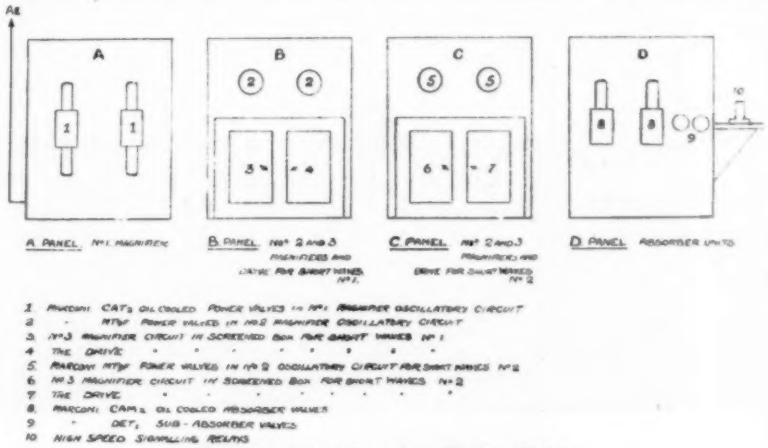

A
B
C
D
A PANEL
B PANEL
C PANEL
D PANEL
1. MARCONI CAT'S OIL COOLED POWER VALVES IN No 1 AMPLIFIER OSCILLATORY CIRCUIT
2. " MT5/7 POWER VALVES IN No 2 AMPLIFIER OSCILLATORY CIRCUIT
3. No 3 AMPLIFIER CIRCUIT IN SCREENED BOX FOR SHORT WAVES No 1
4. THE DRIVE
5. MARCONI MT5/7 POWER VALVES IN No 2 OSCILLATORY CIRCUIT FOR SHORT WAVES No 2
6. No 3 AMPLIFIER CIRCUIT IN SCREENED BOX FOR SHORT WAVES No 2
7. THE DRIVE
8. MARCONI CAT's OIL COOLED ABSORBER VALVES
9. " DET, SUB-ABSORBER VALVES
10. HIGH SPEED SIGNALLING RELAYS

Fig. 1.—Lay-out of Transmitter Panels at Bodmin.

Another pair of stations will shortly be in operation when the two-beam transmitter at Tetney, near Grimsby, and the two-beam receiver at Winthorpe, near Skegness, with the corresponding stations in India and Australia, are completed. All these stations have been designed and erected by or under the supervision of Marconi's Wireless Telegraph Co. for the British General Post Office, and in the Dominions for the national wireless companies. The stations, the erection of which started in April, 1925, have been longer under construction than was at first anticipated, due to the fact that research had to be carried out simultaneously with constructional work. The official Post Office tests laid down that the stations for the Canadian service should be capable of communication at a speed of 500 letters per minute each way (exclusive of any repetitions necessary to ensure accuracy) during a daily average of 18 hours, and that a demonstration should be given by actual working for seven consecutive days. This test took place between October 7th and 14th, and the guarantees have been fulfilled, speeds of 1,250 letters per minute in each direction (equal to 2,500 letters per minute over the complete circuit) having been worked for hours on end. Counting every hour of the seven days' test, the average speed of signalling has been about 600 letters per minute in each direction, or 1,200 letters per minute for the complete circuit.

The Canadian Stations.

The beam transmitting station in Canada is situated at Drummondville, 30 miles east of Montreal, and the receiving station at Yamachiche, 25 miles north of Drummondville. They are linked up by land line to the central office of the Canadian Marconi Company in Montreal in the same way that the English stations are linked to the General Post Office in London. Beam stations are also being erected in Canada for direct communication with Australia, and corresponding beam stations are being built at Melbourne.

The Bodmin Station.

The site of the Bodmin transmitting station is 460 ft. above sea level. In plan, the ground enclosed and the line of masts supporting the aerial system form a broad-arrow head, with the station buildings at the point. The aerial system for the South African beam extends eastwards, while the Canadian aerial system is on the western side of the station. The total length of land enclosed is 6,300 ft., and its width is 300 ft., a total area of 43 acres.

The building work was carried out by the Foundation Co., Ltd. Preliminary details and illustrations were published in our issue of January 15th, 1926.

Power Plant.—The main power is provided by three Ruston & Hornsby heavy-oil engines, each of 165 b.h.p. at 300 r.p.m., and having special seven-ton flywheels to enable them to maintain a steady speed. To prevent vibration reaching the transmitter valves, the engines are mounted on a concrete block, which is floated on "Coresil" cork pads carried on another concrete raft.

For starting the engines there are two air compressors, driven by petrol-paraffin engines, and the following auxiliary generators are driven by 440-volt d.c. motors: (i) Three alternators by the Lancashire Dynamo Co., each of 50 kVA, single-phase a.c. at 1,000 volts, 300 cycles, which supply the anodes of the transmitting valves at 8,000 to 10,000 volts after having passed through special single-phase step-up transformers, the rectifying valves, and smoothing apparatus. (ii) Three alternators by the Electric Construction Co., each of 1.2 kVA, single-phase a.c. at 220 volts, 500

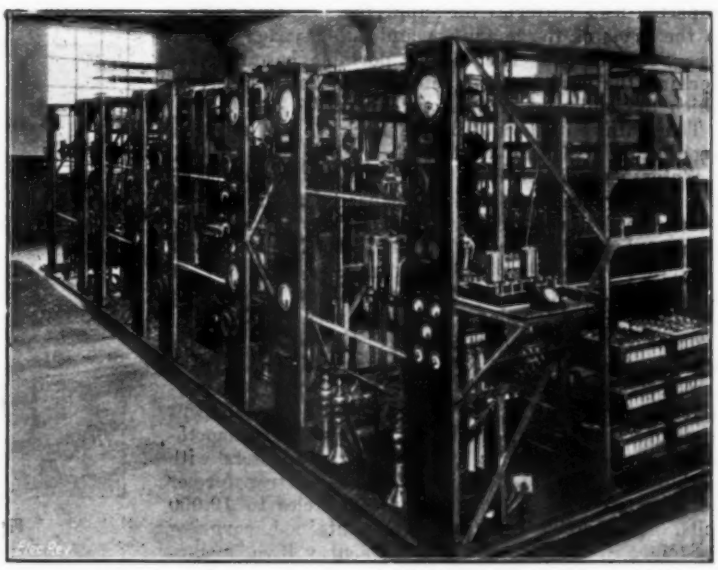


Fig. 2.—Transmitting Plant, Bodmin Station.

cycles, which supply the anodes of the valves in the drive, or master oscillator, panels of the transmitters at 2,000 volts through special single-phase step-up transformers and valve-rectifying and smoothing apparatus. (iii) Two alternators by the Lancashire Dynamo Co., each of 20 kVA, single-phase a.c. at 500 volts, 300 cycles, for heating the filaments of the main- and drive-rectifying valves at 11 to 12 volts through step-down transformers. (iv) Two generators by Newtons, of Taunton, each of 18 kW d.c. at 24 volts for

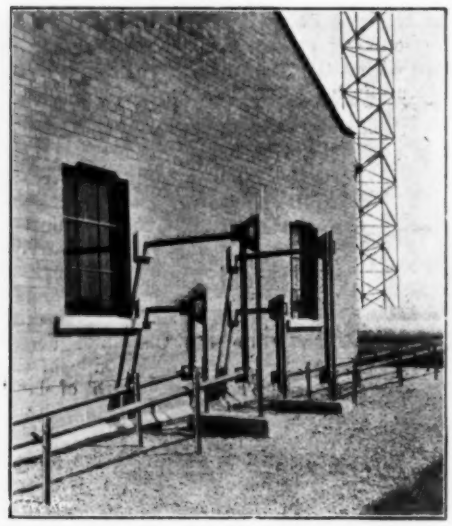


Fig. 3.—Feeder Exit from Transmitter House.

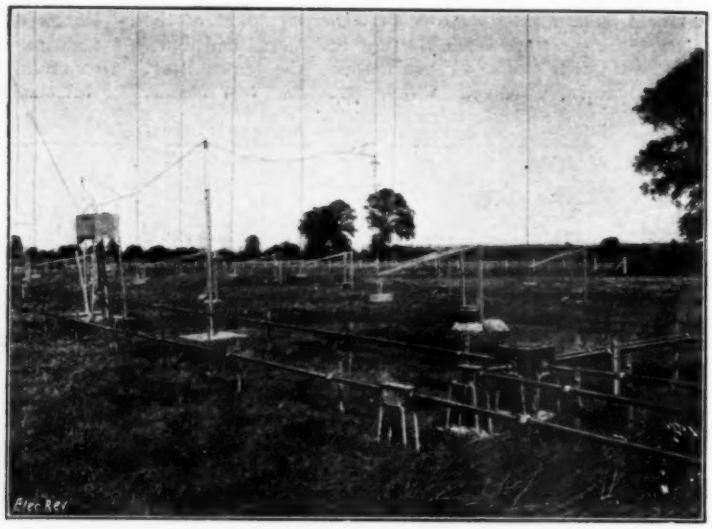


Fig. 4.—Aerial Feeder System and Junction Boxes.

energising the filaments of the transmitter oscillator valves and for charging the batteries which supply the filaments of the drive valves. (v) Two d.c. generators by Newtons, of Taunton, each of 8 kW at 110/165 volts for lighting the buildings, charging the station lighting battery, and for the control and signal relays.

The following batteries are installed:—One 110-volt 330-amp.-hour "Plantide" lighting battery and four 16-volt 420-amp.-hour batteries, two being used alternately on each transmitter, for supplying the filaments of the oscillator valves in the drive and No. 3 magnifier panels. Two 400-volt 5-amp.-hour "Hart" unpasted lead batteries for supplying negative voltage to the grids of the magnifier and sub-absorber valves. Two 200-volt and two 6-volt portable batteries for working the local heterodyne oscillator listening set by which the outgoing signals are checked.

The main switchboard, by the Park Royal Engineering Co., is 70 ft. in length.

Water is pumped from two boreholes for domestic and cooling purposes, and the capacity of the fuel-oil storage tanks is sufficient to enable the station to run night and day for two weeks. A 7½-ton Morris travelling crane spans the main building.

Rectifiers.—Two sets of valve rectifiers provide the high-voltage d.c. anode supplies for each of the valve transmitters. There is one main rectifier and one drive rectifier for each set; each main rectifier carries a bank of 16 Marconi MR.7A valves, and a filament voltmeter. Associated with it are a step-down filament transformer with feed-equalising resistance, two smoothing chokes, three banks of smoothing condensers with discharging switch and resistance, and one transformer stepping up from 1,000 volts at 300 cycles to 10,000 volts. Each drive rectifier is self-contained, carrying two Marconi MR.7A valves, a filament voltmeter, filament transformer, power transformer stepping up from 220 volts at 500 cycles to 3,000 volts, and smoothing chokes and condensers. The main power transformers were manufactured by Messrs. Ferranti, Ltd., and the main rectifier-filament transformers by Johnson and Phillips, Ltd.

Transmitters.—The high-voltage d.c. from the four sets of rectifying and smoothing gear is conveyed by lead-covered cables to the transmitter-room earthing and isolating links. Stability of wavelength, which is of the greatest importance in short-wave work, is obtained by extreme care in the construction of the set. The "drive," or master oscillator, which is entirely screened from the rest of the circuits, controls the transmitter and maintains the intermediate and main oscillatory circuits at the "drive" frequency. The oscillatory circuit of the "drive" is coupled to another oscillatory circuit (known as No. 3 magnifier, an amplifying and stabilising circuit) which, by acting as a buffer between the drive and power circuits proper, helps to maintain the constancy of the drive-wavelength when keying. No. 3 magnifier is completely screened and is coupled to still another oscillatory circuit (No. 2 magnifier), which, in turn, is coupled to the grid circuits of No. 1 magnifier, the main power oscillator of the transmitter, in which oil-cooled valves are employed in preference to water cooling, because valve capacity and resistance losses are reduced more effectively thereby, as oil is a good insulator; the oil used is kerosene, with a slight addition of transformer oil.

The transmitter may consist of three or four panels according to whether one or two distinct wavelengths are

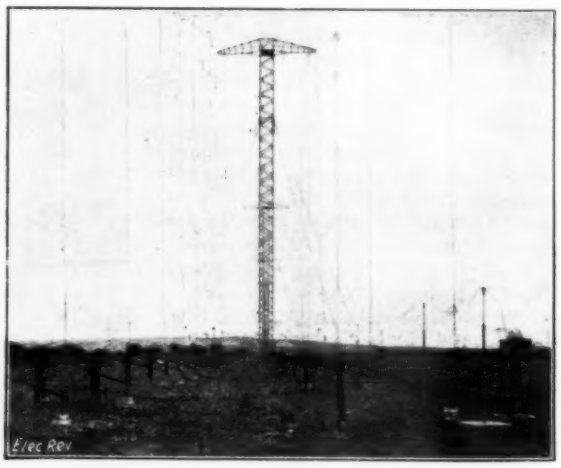


Fig. 5.—Aerial Wire Balance-weight Structures.

to be used. From left to right in figs. 1 and 2 panel A contains No. 1 magnifier, or the power oscillator, and the h.f. coupling circuit to the feeders, which convey the energy to the aerials. The valves used are two of the type CAT2 oil-cooled pattern; their filament voltage varies from 18 to 21, with a current of 50 amps. per valve. The filament, grid, and anode seals are cooled by air blast, and the oil pumps deliver about 300 gallons of oil per valve per hour through the cooling system. The filaments are supplied direct from a 24-

volt d.c. motor-generator; the d.c. anode supply is available at approximately 8,000 to 10,000 volts, and the grid negative biasing when working is approximately 400 volts. During normal working on test the total anode input to the two valves has been approximately 18 kW at a feed of 1.1 amps. per valve. The high-frequency circuits of this panel can be changed quickly from the shorter to the longer wavelength, or *vice versa*.

Panel B contains No. 2 magnifier, which supplies power to the grids of No. 1 magnifier; it has two MT9F air-cooled valves with a filament voltage of approximately 19 V and a current of 12½ amps. per valve. The anode supply is taken from the 10,000-V d.c. main *via* the absorbing resistances and also certain breaking-down resistances. In the "marking" condition the anode voltage is about 5,000 V and the feed 150 milliamps. In the "spacing" condition the valves oscillate so weakly that No. 1 magnifier fails to oscillate at all. The magnifier grid negative biasing when the set is working is approximately 300 V. The filaments are supplied from the same motor-generator as is A panel. The No. 3 magnifier occupies the left-hand compartment of the screening box in B panel and drives the grids of No. 2 magnifier. The h.f. circuit is the same as those in No. 1 and No. 2 magnifiers, except that one valve is replaced by a condenser. The valve is a MT10 air-cooled one, which takes 7.5 amps. filament current and requires a voltage of approximately 12.5. The normal high-tension supply is 1,900 or 2,000 volts and the feed about 80 to 90 milliamps. The drive, which occupies the lower right-hand compartment of the screening box in this panel, has the same high-tension and filament supplies as No. 3 magnifier, the anode voltage and feed current being approximately the same as that of No. 3 magnifier; the circuit, which is self-oscillating, drives the grid circuit of No. 3 magnifier.

Panel C is identical with panel B, except that it is designed for working on a different wavelength.

Panel D contains the main and sub-absorbing and keying circuits which divert the high voltage by means of two CAM2 oil-cooled valves in parallel, through resistances during the spacing periods, and so keep a constant load on the generators; simultaneously with the shunting of the supply, the voltage on No. 2 magnifier anodes is dropped to about 600 volts. The keying current from the high-speed signalling relay fitted on this panel is stepped up to the grids of the CAM2 valves through two DET.1 valves in parallel, the filament voltage of which is 17 to 18 V, and of the DET1 valves 6 V, the filament current being 25 amps. for each CAM2 and 2 amps. for each DET1 valve. This is delivered from the filament lighting machine which supplies the valves in No. 1 and No. 2 magnifiers. The h.t. for the CAM.2 valves is obtained from the same source as for the No. 1 magnifier. The feed through the CAM.2 valves when spacing is equal to the feed through No. 1 magnifier valves (CAT.2), working at a constant high voltage. The grid negative to the CAM.2 valves, supplied from the battery embodied in the panel, is 750 volts; the grid negative to the DET.1 valves is 270 volts; and the grid positive to the DET.1 valves 42 volts.

The transmitter is operated through an "A. T. M." relay to which is connected an adjustable condenser and resistance for balancing purposes, a spare relay being also provided to which connection can be made by means of a change-over switch. As in the case of the engines, each transmitter is mounted on a concrete raft floated on "Coresil" pads. The transmitters also stand on copper trays, which serve as electrical screens and also as receptacles for any oil that may leak from the valve-cooling circuits. The transmitting apparatus and rectifiers were designed and constructed at Marconi's Chelmsford works, and the valves were manufactured at the M-O Valve Company's works, Hammersmith.

Keying.—The method of keying is arranged to keep the load on the power plant constant. During "marking" the high voltage is thrown on to the main magnifiers, but during "spacing" the power is shunted through an equivalent load by means of the panel containing the absorbing valves and resistances. These valves are made conductive or non-conductive as their grids are made positive or negative by the keying relays, the effects of which are stepped up through a small sub-absorber circuit directly influenced in its turn by a small-current land-line relay; in their conducting state the energy is mainly absorbed by mat resistances, cooled by two Sturtevant blowers. This method of keying has the great advantage that there is only one small relay between the land line and the transmitter, which means only one small mechanical motion.

Controls.—The control tables are in the centre of the transmitter room, and carry potentiometer regulators for the main power and "drive" alternators, thus giving complete control in the transmitter room of the high voltages from the power house. There are also two filament-control tables, and variable resistances on the transmitter panels themselves allow for slight differences in filament voltages; there is separate control of each valve. Other tables carry land-line controlling instruments and a local oscillator with a beat-note amplifier and loud-speaker by which the outgoing signals can be listened to, and a standard wavemeter for checking the length of the actual wave which is being radiated.

Valves.—The use of short waves involved the design of special valves to work at the very high frequency employed. This problem has been overcome by the use of valves specially designed for each unit; the main magnifier, a cooled-anode CAT2 valve, will stand an input of 12½ kW at 10,000 anode volts. Three motor-driven centrifugal Rees Roturbo pumps furnish the oil through underground pipes to the valves in the absorber panel and the A panel of each transmitter; there is a separate oil-cooling system with its own pump and piping for each transmitter.

Feeder System.—Very careful attention has been paid to the design and construction of the feeder system through which the aerials are fed with high-frequency current from the transmitter house. The feeder must be air-insulated to avoid loss, and for this purpose it is made of two concentric copper tubes, fig. 3. The outer tube is earthed and carried on iron standards driven into the ground, fig. 4. The inner tube is insulated from the outer by porcelain spacers. The length of feeder tube from the transmitter to each individual aerial wire of that particular aerial system is exactly the same. Two feeders for each service (*i.e.*, Canada and South Africa, one for each wave-band) run from the transmitter building along the front of the aerial system; as there are five masts for each service, forming four bays, two of which are allocated to the aerial system for each wave-band, one feeder runs from the feeder ammeter box in the transmitter room to the centre point of each pair of bays. At that point there is a junction box which divides into two branches, one going to the centre of each bay, where there is another junction box, the process being continued until there is one branch for each pair of aerial wires. At this point there is an aerial-coupling box in which the feeder is again split up so that there is an individual feed to each aerial wire. It is arranged that a transformer may be placed in each feeder junction box to assist balancing; in addition to these coils, condenser tubes, consisting of short lengths of feeder tubing, may be fitted at the coupling boxes for the same purpose.

In each aerial-coupling box there are two coils, mounted on porcelain insulators; both are connected at the bottom to the casing of the box, which is earthed, and tappings from the feeder tube and aerials are connected to suitable points on each coil, which then act as auto-transformers. The lead-in from each aerial is brought through a porcelain insulator at the top of the box. These coils may also be employed as series inductance if required. It should be noted that the aerials and feeders are so adjusted that the sum of the system acts as a pure resistance load on the transmitter so that there is no reflected wave up and down the feeder system.

At the point where the feeder system for each service

leaves the transmitter house there is an ammeter box containing a change-over link which can be connected to either feeder. On the internal side of the link two loops of feeder tube are so arranged that three high-frequency thermo-ammeters come into proximity, although actually situated equally at distances of 32 ft. apart along the feeder. Any reflected waves in the feeder system, as the result of something having gone out of adjustment, are immediately indicated by different readings on the three ammeters. Owing to the great length of tubing in the feeder system, special precautions have had to be taken to provide for expansion.

Masts and Aerials.—Each row of five masts is arranged so that the great circle bearing on the distant station with which that particular system is designed to communicate, is at right angles to the line of masts. As the beam leaves the aerial system at right angles to the plane of the masts and necessarily follows the shortest (or great-circle) track, the distant station must be in the centre of the beam, and will therefore receive the maximum strength of signals. The aerial and reflector systems are identical at both the transmitting and receiving stations. The masts were manufactured and erected by the Armstrong Construction Co.; each weighs 38 tons, with an overall height of 287 ft. to the top of the cross-arms, which are 90 ft. long and weigh three tons. The masts are 650 ft. apart, and the total length of each line of five masts is 3,150 ft. Each mast has four legs standing on concrete blocks, and is 12 ft. square throughout its height, stayed at each leg; each end mast has also four back stays to balance the strain of the steel triatic cables, two for the aerials and two for the reflectors in each bay. The lower end of each aerial and reflector wire is made fast to a balance-weight structure, figs. 4 and 5, it being highly important that the mean distance separating the rows of aerial and reflector wires should be kept constant under variation of temperature and windage.

To provide against breakage during hurricanes, the method of attaching the wires to the balance-weight arms is by means of a trigger arrangement, so that when the balance weight arm has risen about 5 ft. a hook is automatically released from its eye; to prevent the aerial from flying free a check wire is attached.

(To be continued.)

The "RK" Type Radio Loud-speaker.

A Demonstration of the B.T.-H. Co.'s New Moving-coil Instrument.

It is generally agreed that there are definite limitations to perfect reproduction by means of loud-speakers of the conventional type. The advent of an instrument embodying a principle which, though not new, is nevertheless uncommon, and of undoubted merit, is therefore an event of some interest.

Such an instrument is the "RK"-type speaker, the capabilities of which were demonstrated last week during dinner at the

Fig. 1.—The "RK" Loud-speaker Element.

Piccadilly Hotel, London, and created a good impression. It is the invention of Mr. Chester Rice and Mr. Edward Kellogg (of the General Electric Co., of America), and is a departure from previous practice in sound-reproducer design. It utilises a plain paper conical diaphragm so supported that it moves as a whole in a surrounding baffle plate (fig. 1), the latter preventing loss of radiation of sound through circulation of air; in addition to this "air-tight" barrier, the diaphragm is mounted in the centre of a large cabinet (fig. 2) so that the entire front board assists as an interaction preventative. The facts that the cone is "practically unsupported" at its edges and that the moving system has a natural frequency well below the lower limit of the audible range, contribute in no small degree to the excellent performance of the speaker.

The pulsating current derived from the receiving set, after amplification, is circulated through a small annular coil attached to the diaphragm, which it actuates; the moving coil is located in an intense radially-distributed magnetic field, which is energised by eight permanent magnets, approximately 8 in. long by 1¼ in. wide, and about ¼ in. thick, arranged in pairs (fig. 1).

The equipment, as the British Thomson-Houston Co., Ltd., manufactures it for broadcast radio-telephone purposes, consists of a handsome cabinet in which are mounted a complete speaker element and a power amplifier operated by B.T.-H. valves specially designed for the purpose. No accumulators or dry batteries are required, for the set is intended to derive its supply of power from the domestic electricity mains: in the case of a d.c. supply, smoothing and voltage-regulating devices are incorporated in the amplifier (fig. 3); and in the case of

Fig. 2.—Cabinet with Rear Door Removed.

an a.c. supply, rectifying valves are made use of. The "RK" reproducer will function in conjunction with any pattern of receiving set, of good quality, of course, having one stage of low-frequency amplification following the detector.

For the purpose of the demonstration, four such reproducers were operated by means of a small battery-fed B.T.-H. receiving set employing one detector and one l.f. valve, transformer coupled. The aerial consisted of a length of copper wire strung outside the windows of the dining room.

With regard to the performance of the new reproducer, it is not perfect, of course, but is the ideal attainable? The problem of successfully reproducing percussion instruments (drums) remains an elusive one, and the tone of the string instruments did not seem quite natural, but it should be remarked that the building in which the orchestra happened to be playing at the time is far from ideal for broadcasting purposes. As for speech reproduction, it was quite the best we have yet heard. The new speaker is an instrument of undoubted merit and its performance is, on the whole, wonderfully good.

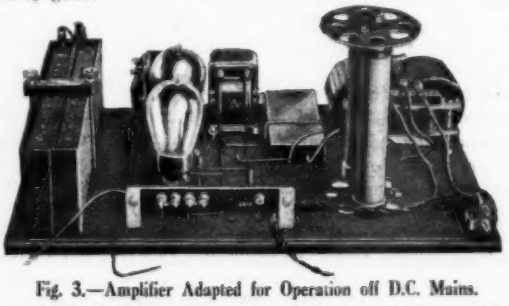


Fig. 3.—Amplifier Adapted for Operation off D.C. Mains.

Among other interesting applications of this instrument may be mentioned the "Panatrope," which the Brunswick Company has developed so successfully. This is an instrument in which the indentations of an ordinary gramophone disk are converted into electrical impulses and reproduced as sound by the "RK" loud-speaker. Other applications, such as "Public Address" systems, band repeaters, and the talking film, are being actively developed, for all of which the Rice-Kellogg speaker possesses inherent advantages.

The Motor-Car Exhibition.

Notes on Some of the Electrical Exhibits.

The International Motor Exhibition, which is held at Olympia, London, is one of the most popular shows of the year. This year's show (October 21st to 30th) is the twentieth of the series organised by the Society of Motor Manufacturers and Traders, Ltd., and is a very fine display, despite the fact that Britain has just passed through one of the greatest internal trials in her history, surely an indication of her striking recuperative powers. The total number of motor vehicles, excluding tramway-cars and trade licences, in respect of which licences were current on August 31st, 1923, may be taken as 1,690,000, including 676,000 cars taxed on horse power, 630,000 cycles, 248,000 commercial goods vehicles, and 99,000 motor hackney carriages.

From the electrical aspect there is little of a novel character to be seen in the equipment of the cars exhibited. Amongst the display of accessories, a new feature on the stand of the Chloride Electrical Storage Co., Ltd., is the range of "Monobloc" batteries in moulded multi-compartment containers, which are designed for mounting on the running board of all popular cars. Fitted with nickel-plated holding-down bolts and moulded lid, this type of battery is electrically and in internal design identical with the other "Exide" starter types.

The Edison Swan Electric Co.'s exhibit includes a range of automobile lamps for every motoring purpose; in the interests of these products the manufacturers have published a booklet on "Night Driving." "Ediswan" dry-charged starter batteries obviate the necessity of a long first charge; all that is required is to fill the battery with pure brimstone sulphuric (accumulator) acid, fit it to the car, and charge it for four hours from the lighting-set dynamo. Other exhibits are petrol-store lighting sets, switchboards for charging accumulators, and garage lighting.

Magnetos of both the rotating-armature and polar inductor types occupy positions of prominence on the stand of the British Thomson-Houston Co., Ltd., which is exhibiting such other products as automatic ignition-timing devices, impulse starters, "Fabroil" silent timing gears, and "Tungar" battery chargers. A special feature in the display of "Mazda" automobile lamps is a special anti-dazzle (bi-focal) headlight bulb, which is provided with two filaments, for use with double wiring and a change-over switch, to permit the use of either a long-range beam, or a depressed-beam by simply switching over. It is claimed that these lamps do what can only otherwise be accomplished by the method of dipping the headlights. They are of the gasfilled type and the glass is corrugated to reduce glare.

Simms Motor Units (1920), Ltd., show magnetos, "Hiwaylite" lighting sets (without accumulators), magnetic tachometers, and a magnetic petrol gauge of simple construction: Underneath the dial is a permanent magnet connected to a steel ribbon, at the lower end of which is a hollow metal float. As the latter travels up and down the inside of the gauge tube, with the rise and fall of the petrol in the tank, it is turned by a spiral cut in the tube; this causes the steel ribbon to turn, likewise the magnet at the top. As the magnet rotates, it exercises its power through the solid head of the gauge and turns the magnetised hand on the face of the dial. It will be observed that the head of the gauge is solid metal. Leakage of fumes or spirit, therefore, are impossible. This instrument is dust, fire, and leak proof.

The "Petromag" locking tap is shown by Messrs. Ross, Courtney & Co., Ltd.; as its name implies, it is a combination of petrol tap, switch and lock, so arranged that when the key is turned and removed, the petrol is turned off, the magneto is switched off, and the whole locked so that the car cannot be started without the key. The A.T. Speedometer Co., Ltd., also offers an electric wind-screen wiper, whilst E.D. Motors, Ltd., shows the "Instarter," which is an electric heater enclosed in a copper tube, and fits in the induction pipe of the car to improve starting and assist slow running. The electric horn operator of Eural Patents, Ltd., is a ring located concentrically inside the steering wheel and actuated by light thumb pressure. Baker & Co. (Coachbuilders), Ltd., show a thermo-electric radiator-temperature indicator and mechanical headlamp dipping mechanism.

The "American Bosch" electric wind-screen wiper is to be seen on the stand of Messrs. Shaw & Kilburn, Ltd., together with "stop" lamps, electric cigar lighters, and the "Luciole" electric radiator heater.

"Lumina" sparking plugs are a feature of the display of Messrs. Motor Pistons, Ltd.; they incorporate "Luminite" (made of rock crystals) as the insulating medium, which is transparent, and the plug is so constructed that the explosion can be seen.

Amongst other exhibitors of lighting and engine-starting and ignition equipment mention must be made of Messrs. Ripaults, Ltd., H. Miller & Co., Ltd., C. A. Vandervell and Co., Ltd., Powell & Hanmer, Ltd., Lucas Electrical Co., Ltd., Rotax (Motor Accessories), Ltd., S. Smith & Sons (M.A.), Ltd., M.C.L. & Repetition, Ltd., Scintilla, Ltd., Delco-Remy and Hyatt, Ltd., and the Société Anonyme pour l'Equipement Electrique des Véhicules.

Messrs. A. Picard (air compressors, magnetic petrol gauge, cables); Richard Melhuish, Ltd. (electric tools); E. Kalker and Co. (magnetos and cables); North & Sons, Ltd. (magnetos); Forward Sparking Plug Co., Ltd.; Peto & Radford (batteries); Howes & Burley, Ltd. (lamps and horns); Klaxon, Ltd. (horns); Lodge Plugs, Ltd.; the M-L Magneto Syndicate, Ltd.; A.C. Sphinx Sparking Plug Co., Ltd.; Sir W. H. Bailey & Co., Ltd. (portable air compressors); J. A. Ryley ("Vita" spark plugs); Oldham & Sons, Ltd. (batteries); Desmo, Ltd. (lamps, horns, and screen wipers); Mann, Egerton & Co., Ltd. (air compressors and garage equipment); John Shaw & Sons, Wolverhampton, Ltd. ("Thor" portable electric tools); Gerrard & Co., Ltd. (electric valve-grinders and other electric tools); Alfred Graham & Co. (electric horns); Robinhood Engineering Works, Ltd. ("K.L.G." sparking plugs); Marelli Magnetos (England), Ltd.; Butlers, Ltd. (lighting devices); Champion Spark Plug Co. of Canada, Ltd.; Benjamin Electric, Ltd. (horns, push buttons, and spotlights); Allen Liversidge, Ltd. (lighting devices); Hart Accumulator Co., Ltd.; Waydicator, Ltd., shows signalling devices for warning drivers following behind.

Finally, a novelty must be mentioned. It is a product of Flexible Lamps, Ltd., and is known as the "Rubbolite" rear lamp for cars, and also signalling lamps, which are unbreakable, as they are made of flexible rubber.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Automatic Operation Recorder.

We have received from the Cambridge Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1, some particulars of an instrument which it has designed to record graphically the operation of the various devices which constitute the switching equipment of automatically-controlled electric substations, fig. 1. A mechanism driven by a small electric motor feeds a paper chart, at a more or less constant speed under 20 pens supported on pivoted arms, the position of each pen being controlled by a small electromagnet; the arms are held in position by gravity. When one of the electromagnets is energised, its armature is pulled into the closed position, moving the corresponding pen a distance of ½ in. across the surface of the chart. The pen tips are equally spaced ¾ in. apart, and are arranged in a straight line above the chart. Ink is

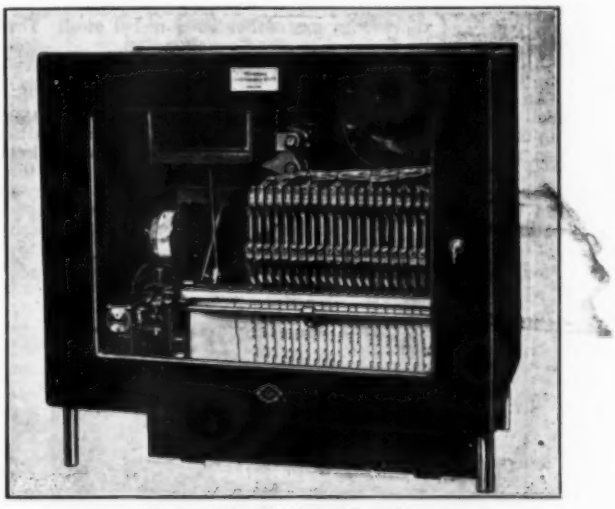


Fig. 1.—Automatic Control Recorder.

supplied from a long trough under the pens, to which it is fed up by capillary attraction. The station load is plotted on a recording ammeter, the pen of which is in alignment with, and makes its record at the same time as the other pens. The recorder chart paper is furnished in rolls having a total length of 50 ft. and a width of 10¼ in. The left-hand section is ruled to accommodate the record made by the pen of the recording ammeter, and the records made by the 20 recording pens are traced on the right-hand section. To register the action of the station devices the magnet of each recording pen is connected in series with its proper external resistance, and across either the contacts, the operating coil, or the series resistor of the device, the action of which is to be recorded. The record made by the instrument shows graphically the chronological operation of the automatic switching devices and the relation of their operation to other circuit variations for which the curve-drawing element is intended. The records are of valuable assistance in checking the sequence of operation of the devices and adjusting the various elements to make the switching equipment function most efficiently. The chart has a speed of approximately 3 or 12 in. per hour, and the time is recorded by means of the 20th pen on the right-hand side, which is operated from a timing quick-make contact every 10 minutes.

D

An Economical Pole Support.

A Spanish concern—the Sociedad de Applicaciones Nuevas del Cemento-Armado, of Guadalapara—has recently introduced a new ferro-concrete support for telegraph poles, known as the "Sanca," fig. 2, for which many advantages are claimed. It is made in two portions, held together, with the base of the pole between them, by long bolts and nuts. The makers claim that the cost of maintenance is reduced to a minimum and that the life of the pole is increased from four to five times that of the normal. Shorter poles can be used with this equipment, and poles, the embedded ends of which have become rotted, can have the rotted portion cut off and still be employed.

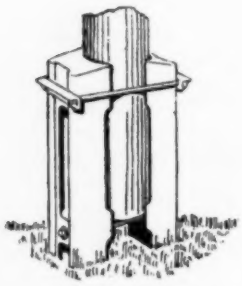


Fig. 2.—Ferro-Concrete Pole Support.

Fig. 3.—Battery Test Meter.

A New Battery Test Meter.

A recent production of the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester, is an automobile battery tester which is believed to be of unique design for British manufacture. Fig. 3 illustrates the device, which is arranged with two prong contacts and a suitable handle. A meter which reads both volts and amperes is held between the prongs and swivels so that the readings can be obtained in any position. A small pilot lamp is arranged so as to be "on circuit" during the test and serves to indicate the state of the battery and also to illuminate the meter face. The meter is of the moving-coil type, and the prongs are of hardened nickel steel. The device is specially designed to stand rough usage.

An Engine Fuel Distributor.

An improvement on the fuel-measuring tubes fitted to the fuel tanks of the early oil-engines of Messrs. Ruston and Hornsby, Ltd., Lincoln, is a recently-introduced apparatus designed to eliminate the danger of one cylinder carrying less than its share of the load, thereby causing overloading of the other cylinders. The new apparatus is claimed to be foolproof and automatically and positively to ensure a uniform distribution of load. Fig. 4 shows the apparatus in position.

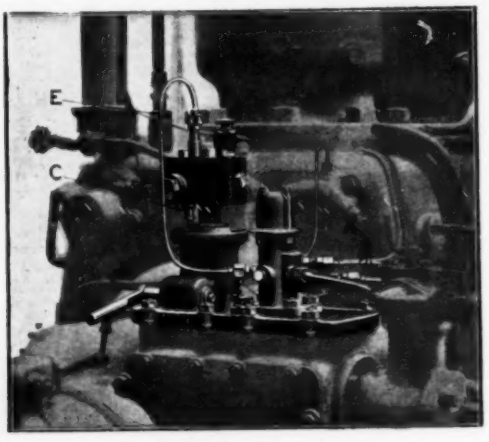


Fig. 4.—Fuel Distributor.

The distributor consists of a reciprocating-plunger unit having the requisite number of inlet and outlet ports. The oil is pumped to it through pipe E and the outlet ports direct the fuel to the various atomisers, *via* pipes A, in the correct sequence. No adjustments are necessary to the distributor, and any adjustment which may be required to the pump is made by a set-screw C. One pump adjustment affects all cylinders alike, thus eliminating any difficulties in tuning.

An Electric Heating Pad.

An addition to the wide range of medical appliances available is the latest introduction of Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, London, W.C.2. The pad, which measures 15 in. by 12 in., is light, fleecy, and pliable, and can be wrapped round any part of the body. It is designed to provide three different temperatures, 120, 160, and 195 deg. F. These are controlled by thermostats, which automatically distribute the heat evenly throughout the pad and maintain it at the temperature desired. The main control for the pad is by a 3-heat regulating switch.

Large Prepayment Meters.

In order to meet the requirements of those consumers who need prepayment meters for heavy currents up to 100 A, British Insulated Cables, Ltd., Prescot, has introduced large meters of this type with provision to avoid the breaking of such high loadings in the same case as the meter. This is effected by installing the switch in a separate chamber under the meter, connection to the standard switchgear being arranged by means of a link. As the tripping gear is operated by means of a relay, no additional effort is required to operate the larger switch.

South African Electrical Notes.

(From Our Durban Correspondent.)

The usual annual list of South African and Rhodesian municipal electrical undertakings now in course of compilation shows marked progress over the previous returns both in the number of towns operating and the amount of energy sold. Of new towns listed, there are no fewer than 41 either about to supply, have lately put plant into operation, or are considering tenders for plant, but these, of course, are of small outputs only; the towns of any importance have long since been catered for in that regard. The total energy sold for the past year by all the municipalities amounted to 223,604,653 kWh, being an increase of 52,813,916 kWh on last year's returns, of which Durban led with 55,844,166 kWh, or practically one quarter of the total. Johannesburg was the next on the list with 54,687,593 kWh, or practically another quarter of the total. Bulk supplies were responsible for 9,894,827 kWh, and it is in this direction that great increases are to be expected in the next few years due to the operations of the Electricity Supply Commission.

Supply at Glencoe (Natal).

Another township to avail itself of bulk supply from the S.A. Electricity Commission is that of Glencoe, which commenced operations in September by taking its supply from the Colenso power station. Current is taken from the railway sub-station, where it is transformed down from 6,600 volts to 380/220 volts and distributed on a 4-wire system by means of overhead mains. The lighting load is 40 kVA and the tariff for lighting is 10s. per month minimum, at 10d. per kWh, and for power £3 per h.p. per year, plus ¼d. per kWh.

Cape Town Extensions.

Owing to the abnormal increase in demand at Cape Town, due partly to the contract already entered into by the Town Council to supply the whole of the Tramway Co.'s demands, large extensions of plant are now in hand, as the demand will have to be satisfied before the Electricity Supply Commission's power station at Salt River can be put into operation.

It is estimated that by 1927 the load on the Council's station will be approximately 20,000 kW. An order has recently been placed for a 7,500-kW, 3-phase, 12,000-V turbo-alternator set with the Metropolitan-Vickers Electrical Co., Ltd., bringing the plant capacity up to 28,500 kW, the contract price, including delivery and erection, amounting to £21,007. Additional boiler plant has also been ordered from Messrs. Babcock and Wilcox, Ltd., for a total sum of £34,215. The boilers will be fitted with Green's economisers, superheaters, water-cooled furnace backs, chain-grate stokers, and forced and induced draught.

Legal.

Patent Rights in the Irish Free State.

In the Supreme Court of the Irish Free State, on October 18th and 19th, before the Chief Justice, Mr. Justice Fitzgibbon, and Mr. Justice Murnaghan, the British Thomson-Houston Co., Ltd., appealed from a decision of Mr. Justice Meredith regarding the validity of its patents in the Irish Free State. In the original action (*vide* Electrical Review, July 16th, p. 123, July 23rd, p. 162, and July 30th, p. 202) the company sought an interlocutory injunction restraining Litton & Co., Ltd., Dublin, from infringing certain of its patents and selling infringing articles. Mr. Justice Meredith dismissed the action, with costs, his view being that the constitution of the Free State appeared to abrogate pre-existing patent rights.

Mr. Overend, K.C., for the appellants, said that the respondents did not deny infringement if the patents were valid in the Free State. Counsel quoted Acts to show that, prior to the constitution of the Free State, British patents were valid in Ireland, and submitted that Article 73 of the Constitution continued those rights. There might be little difficulties in connection with the establishment of a patent office and controller in the Free State, but those were routine matters which could be adjusted. Alternatively, he contended that in Article 11 of the Constitution the rights were preserved as a franchise and prerogative of the Crown.

Mr. Shannon, K.C., said that his clients were not manu-

facturers; the articles in dispute came from French manufacturers. His clients were willing to give an undertaking to keep an account of all their dealings in lamps which should in any way affect the plaintiffs' patent rights. He submitted that their Lordships could not give a final decision as to the validity of plaintiffs' patents, as the matter came before them on an interlocutory injunction. One of the patents had recently been held invalid in France, and other questions might arise, such as leave and licence.

Mr. Overend said that if an interlocutory injunction were granted the appellants would undertake to expedite the trial of the action.

Mr. Shannon replied that an injunction would seriously affect his clients. He could not submit to anything, and was prepared to support Mr. Justice Meredith, who had given a decision favourable to his clients.

After consultation, the Chief Justice said that their Lordships had decided to allow the appeal and grant an injunction; notice would be given to the Attorney-General in view of the constitutional question of law raised, and upon which they would express no opinion. The plaintiffs would have the costs of the appeal, but the costs of both parties in the lower Court would be costs in the action.

Mr. Overend said that the British Thomson-Houston Co., Ltd., would file its statement of claim at once.

A Long-Firm Fraud.

Before Judge Atherley Jones, K.C., at the Central Criminal Court, on October 18th, A. M. Davis, organiser, R. G. Sturdy, clerk, and A. E. Wilson, traveller, were charged with being concerned with other persons unknown in defrauding manufacturers and merchants who supplied them with wireless and other goods on credit. They were further charged with obtaining goods by false pretences. They all pleaded not guilty.

Mr. Percival Clarke, who appeared for the prosecution, said that the case was one of an alleged long-firm fraud. It was the case for the prosecution that more than £1,000 worth of goods were obtained on credit in the names of Landon, Bowman & Co., of Red Lion Square, W.C., and A. E. Wilson & Co., York House, Westminster Bridge Road. Some of the goods were disposed of for cash within a short time of their receipt, at less than cost prices. On numerous occasions false references were given. Goods were obtained from the following firms: Fuller's United Electric Works, Ltd.; E. H. Wilson & Co.; Telsen Electric Co.; Compactom, Ltd.; Edinburgh Roperie & Sailcloth Co., Ltd.; and C. Ede and Co., Ltd. The defendants took a basement at 8, Red Lion Square, and wrote to various firms asking for catalogues and "rock bottom" prices. Business negotiations then commenced, and goods were ordered and delivered after false references had been given. The goods were never paid for. References were supplied, including the South African Trading Corporation and the Universal Commercial Agency, Ltd., which were run by Davis. Davis was also known as Beal, Ltd., G. Ball, and J. Bell. In many cases the persons to whom the references were given did not suspect fraud, and some did not even trouble to find out whether the references were good, bad or indifferent, and as a result large quantities of goods were obtained. When Davis was arrested on August 10th, he said: "I don't think I ought to talk. I will give you no trouble. I think I have an explanation." Sturdy said: "I was known there as Mr. George." He also said that he was a banker. When Wilson was arrested he said: "I know nothing about the affairs of 1925. I am an importer trading as A. E. Wilson, Dover House, Westminster Bridge Road. I share an office with Davis. I don't know the other man." Counsel added that evidence would be submitted that would show that the case was a fraud from beginning to end. The hearing was adjourned.

Further evidence was given on October 20th, and the hearing was concluded on October 25th, when Davis and Wilson were found guilty of the charges. Sturdy was found not guilty and discharged.

Det.-Sergt. W. O. Clarke said that Davis had been previously convicted of long-firm frauds and sentenced to 18 months' hard labour at the County of London Sessions in 1903. He was an undischarged bankrupt, having been twice bankrupt, first in 1914, for £223, when no dividend was paid. He obtained his discharge in 1916, subject to a suspension of two years. In 1922 he was adjudged bankrupt with gross liabilities of £1,027, and he was still undischarged. Since 1923 Davis had been constantly associated in doubtful trading, having been the organiser of P. Alden and E. G. Bates, South Kensington, against whom complaints were received of unsatisfactory trading. Towards the end of 1924 he was concerned in a doubtful business at 105, Upper Tooting Road, known as "The Hosiery." Witness described Davis as a very clever swindler and a man who adopted or implied a different *rôle* in all his transactions. With regard to Wilson, he had been previously convicted for conspiracy to defraud. He was sentenced to six months' imprisonment in the second division last year. Wilson spoke very fluent German, and he had used his knowledge of that language for obtaining goods from a number of German manufacturers without paying for them. Witness added that over 150 manufacturers and wholesale merchants in this country alone had been victimised by the firm of A. E. Wilson of amounts varying from £1 to £50. All kinds of goods had been obtained, including radio and electrical apparatus.

Passing sentence on Davis, the Judge said that he had been convicted on the clearest possible evidence of very dangerous fraud. It was not a case of an attempt to bolster up a decaying business. He had floated the concern simply for the purpose of putting money into his own pocket without any reference to the prospects or hopes of the business. He had only been convicted once before, but that fraud had been so ingeniously and systematically carried on that he could not pass a sentence of less than three years' penal servitude. He sentenced Wilson to 12 months' hard labour, saying that he had probably come under the influence of Davis, who was undoubtedly the principal.

R. E. Giles and Others v. The Brompton & Kensington Electricity Supply Co., Ltd.

Mr. Harold Morris, arbitrator, has issued his award in this matter. The claimants, seven men formerly employed by the company, asked for compensation under Section 16 of the Electricity (Supply) Act, 1919, in consequence of loss of employment, said by them to be due to rearrangement of staff under an agreement between the company and the London Power Co., Ltd.

The company denied that that was the case, urging that the men by leaving their employment without due notice, at the time of the general strike, had been guilty of a wrongful act, as the majority of the strikers had admitted by signing a statement to that effect prepared by the company.

The arbitrator finds that the men's contracts were legally terminated by the company, not in consequence of any agreement between the respondents and the London Power Co., Ltd., and orders the claimants to pay the costs of the arbitration and the respondents' incidental costs.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Thanks!—We desire to thank a number of readers who have forwarded most generously worded congratulations upon the usefulness and timeliness of our "Domestic Electrification Number," which appeared last week.

Liverpool Civic Week.—In the note upon this subject in our issue of October 22nd we stated that the wiring of the exhibition building was carried out by the Liverpool Electric Cable Co., Ltd., and the London Electric Wire Co. & Smiths, Ltd. We are informed by the Liverpool Electric Cable Co., Ltd., that this is not quite correct. Large quantities of the Liverpool company's cable were used by various contractors in the wiring of the building and stands.

Another correspondent informs us that the whole of the electrical installation of the exhibition was entrusted to Messrs. David Rowan & Co., of Liverpool, through Messrs. Albion T. Snell & Partners, under the direct supervision of Mr. Hugh Bourne, M.I.E.E., consulting engineer.

New "Exide" Premises.—To cope with its expanding business in Manchester, the Chloride Electrical Storage Co., Ltd., has lately removed its distributing depôt from No. 1 to No. 18, Bridge Street. The new premises comprise showrooms, offices, storerooms with ample floor space, and a window frontage of 74 feet. The storerooms are equipped for the easy storage and rapid handling of batteries, and special transport facilities have been provided.

Fusion of Chemical Companies.—It was announced last week that negotiations were in progress for the formation of a company to amalgamate the undertakings of Brunner, Mond & Co., Ltd., Nobel Industries, Ltd., the Dyestuffs Corporation, Ltd., and the United Alkali Co., Ltd., for the purpose of "co-ordinating and developing their businesses and resources on broad Imperial lines." The four companies have a combined capital of over £38,000,000.

A Large Refrigerator Contract.—After exhaustive tests, Councillor W. Godfrey Gratten, a pioneer of labour-saving homes, has decided to install a "Kelvinator" automatic electric refrigerator in each of the 2,500 "ideal" homes now being erected on the Eden Park Estate, Beckenham, Kent. It is of interest to know that the plant's name is due to the fact that its action is based upon the thermodynamic principles enunciated by Lord Kelvin.

The F.B.I. and Local Rates.—The Federation of British Industries has addressed a letter to the Minister of Health upon the subject of local rates which, it is stated, are in some districts extremely burdensome to manufacturers. Among the points emphasised are that assessments are based on "annual value," and rates are levied without regard to a firm's actual financial position; and that abnormal distress in certain industrial localities arises from national and even international causes, and should not therefore be relieved by the impoverished locality itself.

Australian Tariff Decisions.—Recent decisions by the Australian Customs authorities include the following:—Lightning arresters (oxide film type) free under the British preferential, the intermediate, and the general tariffs; coil testers (not current measuring), and coil and magneto testers which measure the strength of the magneto current. 27½ per cent., 35 per cent., and 40 per cent. respectively; transformers for 88,000 V and over, free, 5 per cent., and 10 per cent.; and portable electric sand-papering machines, for hand use, free, 5 per cent., and 10 per cent.

Illumination at Blackpool.—The photograph which is reproduced herewith has been sent to us as an example of

The Bath, Blackpool, Floodlighted.

the flexibility and the effects of decorative electric lighting The building is the Bath, and it is floodlighted by means of G.E.C. projectors employing "Osram" gasfilled lamps.

Lead.—Reporting under date October 23rd, Messrs. James Forster & Co. stated:—"The world position is unchanged. Continental demand is slow, and there is no lack of prompt lead in Germany. In this country consumption is being held up by the difficulty of obtaining coal supplies, while in the U.S.A., owing to the reactionary tendency of Wall Street, consumers are holding off the market to await events. Should present conditions continue, it seems probable that surplus Mexican and American lead will find its way to this market, and this, with the present rate of consumption in this country, would be bound to result in a lower range of values. The Board of Trade returns for September, 1926, are:—Imports 25,484 tons, exports 1,089 tons; left for home absorption, 24,395 tons."

Copper, Lead, Rubber and Aluminium Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, October 26th:—No change in copper prices.

Messrs James & Shakespeare report, October 26th:—English pig lead, £31 10s., 20s. dec.

Messrs. Edward Till & Co. report, October 26th:—India rubber, Para fine, 1s. 8d., ¼d. dec.

The British Aluminium Co., Ltd., report October 26th:—The prices of aluminium ingots for home trade are £107 per ton, and for export trade £112 per ton.

The Manchester Lighting Service Bureau.—The opening of the Lighting Service Bureau at Manchester was reported in our issue of October 15th. We have since received photo-

The Manchester Lighting Service Bureau.

graphs of the Bureau, and one of them is reproduced herewith. It shows a part of the demonstration room, and it will be seen that both industrial and domestic lighting are represented by the equipment.

New Municipal Showrooms and Offices.—The Electricity Department of the Hebden Bridge Urban District Council (engineer: Mr. H. H. Sutcliffe) is opening new showrooms and offices early in November. During the first week the showrooms will be arranged as an electric house.

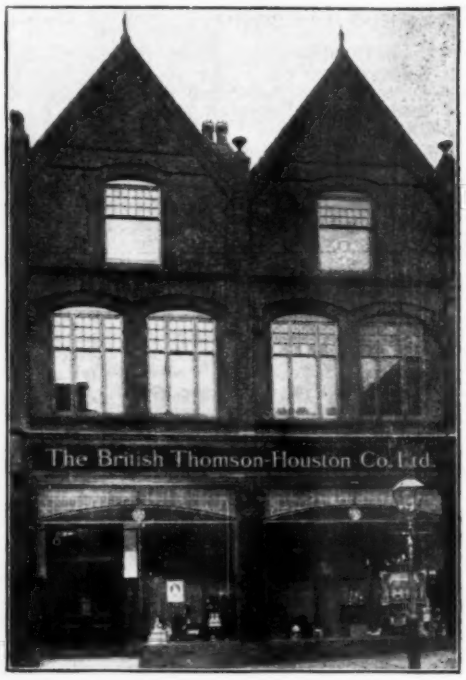
New French Companies.—Among the new concerns recently formed in France in connection with electricity generation and distribution are the Société de l'Union Electrique de la Creuse (4, Rue de Seze, Paris), capital one million francs, to establish power plants in the Department of Creuse; La Société Hydro-Electrique de Cazeres (50, Avenue de la Bourdonnais, Paris), capital 100,000 fr., to acquire and exploit water power concessions in the Department of Haute Garonne; La Société du Secteur Electrique de Dongé-la Haye-Descartes (3, Rue de Douai, Paris), capital 175,000 fr., to establish power stations in the Departments of Vienne and Indre-et-Loire; and La Société Hydro-Electrique des Monts d'Arrée, organised at Kreach-Kelen, Landivisiau (Finistère), capital 3¼ million fr.

Unemployment.—There was a decrease of 36,400 in the number of registered unemployed during the week ended October 11th, the total at that date being 1,536,300, as compared with 1,572,700 on October 4th and 1,258,825 on October 12th, 1925.

Greenock Contract Decision.—The Greenock Corporation, on October 19th, decided that in all tenders preference to the extent of at least 10 per cent. of the total price should be given to British contractors who agreed to carry out the work as far as possible with British labour, plant and materials.

A "Henley" Showcard.—A showcard in colours has been produced by W. T. Henley's Telegraph Works Co., Ltd., advertising the "Henley" wiring system for houses. It is particularly designed for the use of electrical contractors.

New B.T.-H. Premises at Birmingham.—The continued expansion of its Midland business caused the British Thomson-Houston Co., Ltd., to acquire recently new premises in Bir-



New B.T.-H. Premises at Birmingham.

mingham. The new buildings (illustrated herewith) are situated in Snow Hill and consist of extensive stores, a trade counter, and a suite of showrooms for the display of lamps, lighting fittings, radio apparatus, &c. A feature of the main showroom is a demonstration shop window which different business houses in the city are invited to dress from time to time.

Rumoured European Electricity Combine.—The *Narod Osvobozeni* states that a fresh attempt is to be made to create a European electricity combine. As understandings already exist between the German and Czecho-Slovak concerns on the one hand and between the German and Austrian concerns on the other, the idea has arisen of combining the German, Austria, Czecho-Slovak, and Swiss industries. The discussions which have recently taken place at Vienna between Czecho-Slovak, Austrian, and Swiss interests, promise to yield favourable results. The Russian market was also discussed.—*Reuter's Trade Service* (Prague).

The Travellers' Concert.—The Electrical Trades Commercial Travellers' Association commenced its winter season on Friday, October 15th, with a Bohemian concert at the Old Colony Club. There was a very good attendance in spite of inclement weather. During the interval the Chairman, Mr. E. A. Joyce, explained the various activities in which the Association interested itself. The next social function of the Association will take the form of a dance on December 3rd.

Electric Iron Contract.—The Electric Heating Co., Croydon, states that it has recently received an order for six dozen of its "Elect" smoothing irons for a West End laundry.

Employment during September.—The *Ministry of Labour Gazette* states that employment in the engineering industry remained very bad during September, showing little change as compared with the preceding month. The electrical branch, however, showed a slight improvement, the proportion of unemployed falling from 7.9 to 7.5 per cent., against the total average for the whole of the engineering industry of 16.3 per cent. In the electrical wiring and contracting industry there was also an improvement, the unemployment percentage having fallen from 14.9 to 10.9. The figure for the electrical cable, wire and electric lamp manufacturing industries remained stationary at 7.4 per cent.

Local Exhibitions.—ST. MELLONS (CARDIFF).—At a recent agricultural exhibition at St. Mellons, near Cardiff, the South Wales Electrical Power Distribution Co. organised an electrical exhibit in a marquee. A part of this exhibit is illustrated in the accompanying picture. The show consisted of cookers, washing machines, vacuum cleaners and examples

Electricity at a South Wales Agricultural Show.

of all the smaller domestic appliances. Although only open for part of a day, the marquee had 600 visitors and proved very successful. For the purposes of the exhibition the company ran an overhead line on scaffold poles from its Rumney sub-station.

EDINBURGH.—The Corporation Electricity Department was represented by an excellent display of heating and cooking apparatus at an exhibition promoted by the British Towns Exhibition Association, Ltd. Among the 100 stands were many showing the advantages of electricity. Major Raymond Phillips demonstrated a method of controlling railway trains by radio. On October 28th, Mr. H. E. Hughes, Scottish Electric Lighting Service Bureau, spoke on "Modern Lighting."

HELENSBURGH.—An electrical exhibition, arranged by the Clyde Valley Electrical Power Co., was opened in Victoria Halls, Helensburgh, on October 20th. Mr. E. T. Goslin, M.I.E.E., general manager of the company, who presided at the opening, stated that it had cost about £33,000 to bring electricity into Helensburgh. Among the exhibitors were the Clyde Valley Electrical Power Co.; Metro-Vick Supplies, Ltd.; the General Electric Co., Ltd.; the Edison Swan Electric Co., Ltd.; the British Thomson-Houston Co., Ltd.; Hoover, Ltd.; Frigidaire, Ltd.; the Falkirk Iron Co., Ltd.; W. C. Yuille and Co.; L. G. Hawkins & Co.; Archibald Low & Sons, &c. Practical cooking demonstrations were given daily, and on Friday last there was a special session for cooks. Mr. H. E. Hughes, district engineer, Scottish Electric Lighting Service Bureau, gave demonstrations, and spoke on illumination questions.

SALTAIRE.—An electrical exhibition organised by the Shipley Electricity Committee was held at the Victoria Hall, Saltaire, recently. The exhibitors included the Credenda Conduits Co., Ltd., Messrs. J. E. Kay & Co., Gordon Binns, W. Harper, and Messrs. Lindley's.

DOVERCOURT.—An electrical exhibition arranged by the Harwich Municipal Electricity Department was held at the Drill Hall last week. The opening ceremony was performed by the Mayor (Capt. A. R. Peake), who congratulated Mr. E. Jordan, the electrical engineer, on the excellent arrangements. Up-to-date electrical devices for lighting, heating, and cooking were displayed, and practical demonstrations were given to large numbers of interested visitors.

TUNBRIDGE WELLS.—An excellent display of electric heating, cooking, and labour-saving devices was recently arranged at the Pump Room by the Electricity Department (engineer: Mr. R. N. Torpy). A number of local electrical firms had stands representative of a wide range of appliances. The exhibitors included Mr. H. Featherstone (fires, radio apparatus, &c.); Messrs. Paine, Smith & Co., Ltd. ("Magnet" cooking and baking apparatus); Messrs. G. & J. A. Cross, Ltd. (washers, vacuum cleaners, lighting fittings, &c.); the Premier Electrical Co. (lighting glassware, cookers, sewing machines, &c.); Mr. C. Elphick (fires, washing machines, &c.); Messrs. E. Powell, Ltd. ("Creda" cookers, irons, lighting fittings, &c.); the Advance Electrical Co. ("Hoover" vacuum cleaners, "Kelvinator" refrigerators, &c.); Messrs. H. A. Stonham & Co., Ltd. ("Holophane" lighting fittings, electro-vapour radiators and labour-saving devices); and Messrs. Strange & Sons Electrical Engineering Co., Ltd. (fires, ironers, reflectors, &c.).

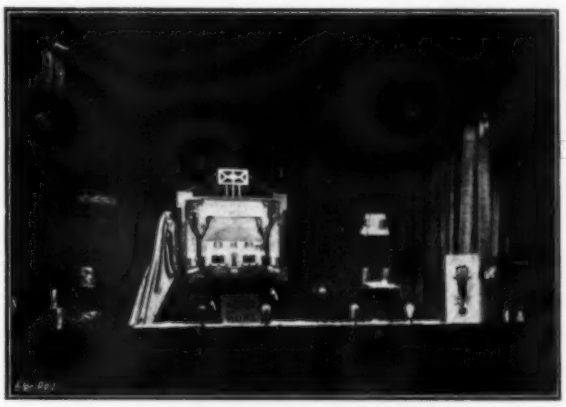
WEST HAM.—A report upon the recent exhibition organised by the Municipal Electricity Department (engineer: Mr. F. W. Purse) shows that there were 6,941 visitors during the week. No fewer than 58,000 pamphlets, &c., were given away, and 279 definite inquiries were received. Although the full effects of the exhibition have not yet been felt, the sales made to date as a direct result are as follows:—Cookers 26, radiators 40, washers 6, water heaters 4, vacuum cleaner 1, and lighting installations 60. It is estimated that these connections alone will result in a permanent additional revenue of about £400 per annum. The all-electric tea room proved very successful. It is considered that the net cost of the exhibition was only £10, and subsequent inquiries have practically wiped this out. Mr. Purse says:—"The exhibition may therefore be looked upon from all points of view as an unqualified success, and truly emphasises the saying that 'It pays to advertise.'"

American Electrical Loans.—A number of important electrical issues are included in a list of American loans to foreign concerns during the third quarter of this year, published by *Commerce Reports*. Among them are the following:—The Oberpfalz Electric Power Corporation (Germany), $1,250,000; the Mannheim and Palatinate Electrical Companies (Germany), $2,675,000, the Leipzig Overland Power Co. (Germany), $2,425,000; the Siemens & Halske Corporation (Germany), $18,500,000; the International Telephone and Telegraph Corporation (Spain and Italy), $19,000,000; the Gatineau Power Co. (Canada), $5,000,000 and $2,500,000; Shawinigan Water and Power Co. (Canada), $3,000,000 and $200,000; Habana Electric Railway Co. (Cuba), $5,500,000 and $5,000,000; and the Toho Electric Power Co. (Japan), $10,000,000.

A Works Handbook.—A rather novel publication is being circulated by the Chloride Electrical Storage Co., Ltd. This is a "Works Handbook," in which are set out details of the welfare and other arrangements which the company has instituted for the benefit of its employés. Many matters are dealt with, such as protection against lead poisoning, the pension scheme, evening classes, recreation, &c.

Western Australia: Electricity Supply Statistics.—We have received a printed table giving particulars of 77 electricity supply stations in Western Australia. It gives the name of the supply authority, year of opening, type and capacity of plant, voltage, periodicity, and charges. It was compiled in July, 1926, by Mr. A. F. Williamson, M.I.E.E., M.I.E.A., electrical engineer, Public Works Department, Perth.

The E.D.A.-E.L.M.A. Campaign.—The accompanying picture is a view of a window display arranged by the Birmingham City Electric Supply Department at its Paradise Street showrooms. It indicates that the Department is setting an example to other electricity supply authorities in promoting



A Campaign Window at Birmingham.

the success of the "Wiring the Homes of Britain" campaign. The poster illustrating the prize home is prominently shown and it is supported by a simple arrangement of lighting equipment.

No. 3 of the "Home Lighting News" has now been distributed. It contains many notes upon the progress of the campaign in all parts of the country. The illustrations include views of the first campaign electric house at West Hartlepool, a model of the prize house, and the November shop-window display for contractors. In the last the prize house poster again forms the centre piece, and various makes of electric fires are grouped round it.

The following is a list of local "Circles" formed during the week ended October 23rd, in connection with the campaign. The chairmen's names are given in parentheses:—Aberdeen (Mr. J. A. Bell), Torquay (Mr. H. F. G. Woods), Leicester (Mr. J. Orringe), Walsall (Mr. H. A. Howie), Wolverhampton (Mr. E. Morgan), Saltburn (Mr. T. T. Willis), Whitby (Mr. J. W. Piggott), Sunderland (Mr. A. S. Blackman), Tottenham (Mr. F. T. Hall), Leatherhead (Mr. Horner, *pro tem.*), Ipswich (Mr. G. L. Garton), Dewsbury (Mr. Derwen Jones), Hebden Bridge (Mr. H. H. Sutcliffe), Liverpool (Mr. H. Dickinson), Keighley, Darlington, West Hartlepool, Durham,

and Carlisle. During the week demonstration electric homes were opened in the following districts:—Gosforth (Newcastle-upon-Tyne), Liverpool, and Tanfield (Northumberland).

About 50 visits to towns outside district headquarters cities were made by the District Officers during the week. A mass meeting in Bristol was addressed by Mr. Bush on October 12th, and similar meetings in Newcastle and London were addressed by Mr. Dale on October 14th and 15th. District meetings have been held at Greenock, Liverpool, Southport, Aberdeen, Leicester, Walsall, Wolverhampton, Potteries District, and Dewsbury.

Aberdeen is making arrangements to run a demonstration electric home, and the Birmingham demonstration home (No. 1) was to be opened during this week. The Harrogate circle has raised a guarantee fund of £115, and this is likely to be augmented considerably; it proposes to equip an electric demonstration home. Goole (Yorks.) and Southport hope to run demonstration electric homes. At Denton (Manchester) a local builder and a contractor have expressed their willingness to finance a demonstration house, and Dewsbury and Batley are arranging three houses. Work is well in hand with the Lincoln demonstration.

Book Notices.—"Collins' Engineers' Diary, 1927." London: Collins' Clear Type Press.—This is an addition to the number of diaries of this character issued every year. In some 128 pages an unusually large amount of engineering data and information is contained, including much electrical matter. The aim of the publishers has been to provide a vital annual in the form of a diary which will prove of real service to engineers of all branches. The leading aspects of engineering have been brought under review, providing a dependable guide arranged for quick reference. The diary portion is arranged with four days to a page. The publication is issued in seven different bindings of the fast-bound type, and four styles of renewable cases with the necessary yearly refills.

"Scientific Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 530.—Establishment of Radio Standards of Frequency by the use of a Harmonic Amplifier. July 15th, 1926. Price 10 cents.

Handbook Series of the U.S.A. Bureau of Standards. No. 8, "Safety Rules and the Operation of Electrical Equipment and Lines"; comprising part 4 of the fourth edition of the National Electrical Safety Code. July, 1926. Price 15 cents.

"Aluminium in Foundry Work." Pp. 91; figs. 42. Published by the British Aluminium Co., Ltd.—This book, the first sections of which formed the basis of a lecture given by Mr. Mortimer to the Institute of British Foundrymen, discusses the development of the use of aluminium for general purposes where lightness is of no particular advantage.

"Junior Technical Electricity." 2nd edition. By Robert W. Hutchinson, M.Sc. Pp. viii+385; figs. 327. London: The University Tutorial Press, Ltd.—In this edition some additional matter has been inserted in connection with "wireless" circuits.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV. October, 1926. No. 358. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Quarterly *Bulletin* of the British Cast-Iron Research Association." No. 14. October, 1926.

"Alternating Current Rectification." by L. R. W. Jolley. Second edition. Revised and enlarged. Pp. xxii+472. London: Chapman & Hall, Ltd. Price 30s. net.

Trade Announcements.—New showroom premises and a radio store have been opened at 126, High Street, Deal, by Mr. C. O. Clark, electrical engineer, of Mill Road.

Further lines have been added to the telephone service of the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. "Regent 7050" now has 61 lines.

Mr. R. C. Hall, of "Oakleigh," College Road, Rondebosch, is manager of Sharwood's Battery Service station in Port Elizabeth, and is doing good business with country garages. He is open to accept agencies for farm and country-house plants.

Messrs. Wm. Geipel & Co. have been appointed sole agents for the United Kingdom and the British Colonies for the Società Anonima Fabbrica Isolatori Liverne, of Milan, for h.d. insulators. The company has published two catalogues fully illustrating its products; one is in Italian and the other in English.

Catalogues and Lists.—Messrs. E. P. Allam & Co., Ltd., 107-109, Gray's Inn Road, W.C.1.—Stock list of electric motors, &c.

The British Electrical & Manufacturing Co., Clavering Place, Newcastle-on-Tyne.—A priced and illustrated pamphlet advertising the "Orion" vacuum cleaner.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for October, containing articles and notes upon the company's radio components, automobile accessories, and lighting equipment.

Messrs. I. Calvete, Ltd., 11, Little St. Andrew Street, W.C.2.—A well-illustrated catalogue of high-frequency sets, ozonisers, massage apparatus, and other electro-medical equipment; fully priced.

Automatic & Electric Furnaces, Ltd., 173-175, Farringdon Road, E.C.1.—Catalogue Section K dealing with resistor furnaces suitable for temperatures up to 1,400 deg. C.

Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Catalogue No. 571, containing numerous illustrations of artistic lighting glassware. Several pages are in natural colours. Priced.

The Bastian Meter Co., Ltd., 58, Haymarket, S.W.1.—Leaflet No. 14/48-49, dealing with small "Bastian" fires and heaters, and "Bastolite" compound.

The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.—Illustrated pamphlet advertising the company's high- and low-tension batteries for radio work.

Ebonestos Insulators, Ltd., Excelsior Works, Rollins Street Canterbury Road, S.E.15.—A priced pamphlet advertising "E.I.L." shrouded (Home Office) lampholders.

The Sloan Electrical Co., Ltd., 8-12, Golden Lane, E.C.1.—An illustrated and priced catalogue of electrical accessories, porcelain insulators, and telegraph ironwork.

Messrs. E. Brook, Ltd., Empress Works, Huddersfield.—A pamphlet advertising "Brook" motors fitted with ball bearings.

Welco Patents, Ltd., 6, Dowgate Hill, Cannon Street, E.C.4.—A wall calendar illustrating examples of "Welco" slotted-steel shelving, benches, &c.

Messrs. S. G. Brown, Ltd., Western Avenue, North Acton, W.3.—The "Brown Budget" for October, containing interesting articles and notes upon the company's organisation and products.

The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—A handbook entitled "Night Driving," containing an article upon this subject and particulars of "Ediswan" automobile lamps.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for October, containing illustrated articles and notes on "Osram" lighting installations, radio valves, &c. Also Leaflet No. S.3878, bearing coloured illustrations and prices of tumbler switches with "Ivoride" covers.

Messrs. S. H. Morden & Co., Ltd., 18, Dartmouth Street, S.W.1.—An illustrated booklet dealing with "Flextol" power-driven hand tools—screwdrivers, drills, grinders, &c.

Magnum Electrical Appliances, Upper Elmers End Road, Beckenham.—A mailing card advertising the "Magnum" electric iron.

Mr. Cecil Ridley, Dundas Mews, Middlesbrough.—A price list of non-Association v.i.r. cables and wires.

Messrs. W. Crockett & Sons, Ltd., 64, Darnley Street, Glasgow.—A pamphlet describing the "Simplex" valve-reseating machine.

Metro-Vick Supplies, Ltd., Trafford Park, Manchester.—A 48-page catalogue of "Cosmos" radio sets and accessories, fully illustrated and priced. Also separate folders dealing with valves and other components.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—List No. 36, containing details and prices of time switches for shop-window lighting, protective lights, radio sets, &c.

British Insulated Cables, Ltd., Prescot, Lancashire.—Catalogue No. P.206, containing a detailed, illustrated description of "Prescot" a.c. meters. Diagrams of connections are included.

Bankruptcy Proceedings.—H. D. Douglas (trading as H. D. Douglas & Co.), merchant and radio factor, 32, Queen Victoria Street, E.C.—The public examination of this debtor was held on October 20th, at the London Bankruptcy Court, before Mr. Registrar Warmington. The debtor, who filed his own petition, applied to pass upon accounts showing total liabilities £5 284 (unsecured £4,024), and assets valued at £531. In reply to the Official Receiver, debtor said he commenced business in June, 1918, and traded with success until 1924, but it thereafter gradually declined owing to depression in trade and to bad debts. In consequence of pressure by creditors he closed down last March, a further cause of the failure being law costs. The examination was concluded.

J. Segal, 2, Vine Street, Tooley Street, E.C., electrical accessories merchant.—Receiving order made September 2nd, on a creditor's petition. First meeting, November 3rd. Public examination, December 7th, both at Carey Street, W.C.

F. A. Hartley & R. Hartley, 98, Katherine Street, Ashton-under-Lyne, electrical engineers.—First meeting was to be held yesterday (Thursday). Public examination November 29th, at the Town Hall, Ashton-under-Lyne.

R. V. Sellers (The Wireless Supplies & Installations), wireless engineer, Town Hall Buildings, Banbury.—Receiving order made October 19th, on debtor's own petition.

G. Wintersgill, electrical engineer, Hawnby Road, Linthorpe, Middlesbrough.—Receiving order made October 19th, on creditor's petition.

J. R. Charnock, cycle dealer and electrical engineer, 6, Stonegate Road, and Meanwood Road, Meanwood, Leeds.—Last day for proofs for dividend, November 10th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

C. Hubbard, electrician, 13, Magdalen Street, Norwich.—First dividend of 7s. 6d. in the £, payable November 3rd, at the Official Receiver's office, 9, Queen Street Chambers,

Company Liquidations.—Autochrome Signs, Ltd.—A meeting of creditors was held on October 15th, at the offices of the liquidator, Mr. Howard Button, 61-62, Lincoln's Inn Fields, W.C. A statement of affairs was submitted which disclosed liabilities of £599, all due to unsecured creditors. The net assets were given as £603, which was insufficient to meet the debentures and interest amounting to £795. The issued capital of the company was £800. It was reported that the company was formed in July, 1924, and traded at a small profit for the first year. During the last year, however, it had done very badly, and it was affected particularly by the coal

strike, as no electric signs were allowed to be used. Debentures were issued in June, 1925, and £750 was provided in cash. The receiver for the debenture holders stated that the assets were of a very meagre nature, and if he had attempted to sell them under the hammer they would have realised practically nothing, but he had obtained an offer of £500 for the business, and the amount of the book debts, which made a total of £660. After the debenture holder had been paid the unsecured trade creditors could not expect to receive any dividend. No resolutions were passed, and the matter remains in the hands of Mr. Button as liquidator.

Hirst Brothers & Co., Ltd., Oldham, manufacturers of radio apparatus, &c.—Particulars have been issued of a scheme of arrangement in connection with the affairs of the above company, which went into liquidation in April last following the appointment of a receiver for debenture holders. At the statutory meeting in connection with the voluntary liquidation it was reported that the assets might realise about £60,000, and after the debentures and other charges had been deducted there would be about £15,000 available for the unsecured creditors. The amount due on the debentures, held by the bank, was £42,000. Under the scheme it is proposed that the issued capital of £132,434 shall be written down by 19s. 3d. in the £, with the result that each shareholder will be entitled to one share of 9d. credited as fully paid for each £1 of capital previously held. It is suggested that the unsecured creditors shall receive shares to the value of 7s. 6d. for each £1 of their claims. It is also provided that a new board of directors shall be appointed, including three representatives of the unsecured creditors and one from the employés. When the creditors met in April they appointed a committee of those principally interested, and this committee estimates that in a realisation there would be an approximate dividend of 3s. in the £ for the unsecured creditors. The liquidator is empowered to purchase the claim of any creditor at 3s. in the £ on behalf of clients having no connection with the company at present. Under the scheme provision is also made for the withdrawal of the receiver for the debenture holders.

Gas & Fuel Plants, Ltd.—Winding up voluntarily. Liquidators, Mr. G. M. Lemonius, 5, Victoria Street, S.W.1, and Mr. J. H. Macaulay, 3, London Wall Buildings, E.C.2, appointed October 15th. Meeting of creditors November 1st, at 3, London Wall Buildings, E.C.2; particulars to be sent to the liquidators by October 30th.

Electric Repairs, Ltd.—The liquidator (Mr. J. T. Bunch) has issued a statement to creditors showing that the amount realised from the sale of this company's assets is insufficient to cover his remuneration after paying preferential creditors.

Deeds of Assignment.—J. Cooklin (Eunice Wireless Cabinet Works), 16, McGarth's Place, Hoxton, E.—Particulars of claims by November 9th to the Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2.

W. L. Mays, electrical engineer, 91, Southampton Row, W.C.—Particulars of claims by November 9th, to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Fuel Shortage in Denmark.—The Copenhagen Corporation announces that it may be necessary to reintroduce the rationing of gas and electricity and to prohibit the use of electric signs owing to the shortage of coal and Westphalian coke. Denmark is entirely dependent upon foreign fuel.—*Reuter* (Copenhagen).

Selling Powers Proposed for Bedford.—The Bedford Electricity Committee recommends the promotion of a Bill to enable the Corporation to sell electrical fittings and apparatus.

Brown, Boveri Developments.—Owing to the building being required for an extension of its electrical engineering department, the Brown-Boveri Co. is closing down the foundry at its works at Baden. It is stated that the bulk of the foundry work required will in future probably be supplied by Sulzer Bros., who are arranging to re-open their old foundry at Bulach.

Machine Tool Display.—Messrs. Buck & Hickman, Ltd., have arranged at their Whitechapel Road premises a display of production machine tools. These include automatic lathes, milling machines grinders, gear generators, &c. A catalogue of the machines has been produced by the company.

Water-Heating Contract. — The L.G.O.C. Employés' Death, Distress, and Sick Friendly Society has decided to install electric water heating in its convalescent home at Hastings, and has placed a contract for the necessary plant with the Bastian Meter Co., Ltd. (Bastian & Allen).

Swiss Orders.—At the recent meeting of the investment company known as the Bank for Electrical Undertakings, Zurich, it was mentioned that during the past year it had been possible for the bank to ensure the allocation to Swiss industries of orders of the value of over 12,900,000 fr.

New Zealand Tariff.—Among recent amendments to the New Zealand Customs tariff is one affecting electrical tractors suitable for use in warehouses or upon wharves and pavements. The new duty on these is 10 per cent. *ad valorem* under the British preferential tariff, 25 per cent. under the intermediate tariff, and 35 per cent. under the general tariff.

New Australian Company.—H. D. McCredie & Co., Ltd., is the name of a company recently formed in Sydney (N.S.W.), with a capital of £30,000, to carry on the business of electric and hydraulic lift makers and repairers, &c.

Australian Copper Production.—Australian producers of copper recently applied to the Tariff Board for a bounty upon production. Later, application was made for an increase of duties upon imported copper and copper alloys. The latter application was vigorously opposed by representatives of British copper producers, who pointed out that Australian refiners were already able to underquote them, and that such competition as existed came from Continental countries.

Assistance for Esthonian Exporters.—In order to encourage the manufacture and exportation of telephone apparatus, the Esthonian Government has lately issued new regulations providing for the refund, upon the exportation of telephone apparatus and manufactured parts of telephones, of the duty paid on the imported raw materials used in their manufacture.

Polish Foreign Electrical Trade.—The *Board of Trade Journal* states that during August Poland imported apparatus, conductors and other electrotechnical materials to the value of 3,0.3,000 gold zloty, and exported similar goods to the value of 25,000 zloty.

Lantern Slides.—Automatic and Electric Furnaces, Ltd., states that it has available for engineering societies or other associations a complete series of lantern slides, illustrating various types of electric furnaces used in different industries, automatic temperature controls, and wiring diagrams of various forms of circuits. A full description of these slides in the form of a lecture can be supplied, if required.

Birmingham Radio Show.—It is probable that Birmingham will now have an annual wireless exhibition. Approximately 22,000 people visited the Exhibition which concluded on October 16th, after 11 days' run, and Mr. H. A. Pratt, the manager of the Exhibition for Provincial Exhibitions, Ltd., states that about 20 firms have suggested that the show should become an annual event, and several have intimated their willingness to take increased space. It is probable that a larger and more centrally-situated hall, with better facilities for demonstrations, will be engaged if the Exhibition is repeated next year.

The Anglo-Spanish Commercial Treaty.—In the House of Commons on October 25th, Sir Philip Cunliffe-Lister said that it was proposed to open negotiations with a view to the revision of the Commercial Treaty with Spain. The Spanish Government had been informed that, failing a satisfactory revision, the Treaty would be brought to an end on April 23rd next year.

Lighting and Power Notes.

Ashford.—Inauguration of Supply.—The Urban District Council's power station was formally inaugurated by the Duke of York on October 20th, and the public supply is expected to be available early in November. According to the *Kentish Express and Ashford News*, the plant includes three 400-kW Diesel engines supplied by Messrs. Ruston & Hornsby, Ltd. The standard system of supply has been adopted so that if bulk supplies under the Government scheme are introduced the plant can be adapted at small expense. A h.p. supply is being taken by the Southern Railway Works, where converting plant is being installed, and approximately 400 applications have been received for a supply. Electricity will be distributed at a pressure of 230 V for domestic use. The Council has powers to supply in the urban district, the rural district of West Ashford, and to certain properties in East Ashford rural district. The electrical engineer is Mr. H. Wilson.

Australia.—Melbourne.—According to the *Australasian Electrical Times*, the conversion of Melbourne's industrial suburbs to 3-phase supply is proceeding rapidly, and the load on Yallourn and the Yarraville terminal station is steadily increasing. The whole of the Collingwood, Richmond, and South Melbourne industrial areas will be receiving 3-phase supply by about the end of 1926, and the Richmond power station of the Melbourne Electric Supply Co., Ltd., will then be closed.

Barnsley.—Loans.—The Electricity Committee has received sanction to loans of £42,000 for electricity extensions, and £1,678 for mains.

Bingley (Yorks.).—Loans.—The Lighting and Tramways Committee has recommended to the Urban District Council that application be made for sanction to loans of £10,000 for mains and £5,000 for domestic appliances to be let out on hire.

Bradford.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer, Mr. T. Roles) for the year ended March 31st last, shows a total income of £494,388, and working expenditure of £273,753, leaving a gross surplus of £220,635. The figures for the preceding year were:—Income, £483,385; working expenses, £259,468; gross profit, £223,917. To the gross surplus was added a Government grant of £1,147, making a total of £221,782. Capital and other charges absorbed £200,572, leaving a net profit of £21,210, as compared with £38,723 in the previous year. A contribution of £18,000 was made to the district rate. The capital expenditure during the year amounted to £181,625, the chief items being £58,980 for plant, &c., at Valley Road station, and £116,664 for mains and services. The sales of electrical energy increased from 69,347,691 to 73,448,196 kWh, and the average price per kWh obtained fell from 1.585d. to 1.534d. The maximum supply demanded rose from 32,695 to 38,300 kW.

The Electricity Committee's report on the working of the department covers the municipal year ending with the current month. Extensions carried out during this period included the installation of a 16,000-kW turbo-alternator, which was formally started up in November last, and additional switchgear and rotary converters at Thornby and Odel sub-stations. The Four Lane Ends sub-station was formally inaugurated on October 13th, and will be used for improving the supply to the tramway to Thornton and Allerton. A scheme for the hire of cookers was introduced during the year, and approximately 400 are now in use under this scheme. Considerable progress was made with the work of changing over the system of supply in certain districts from d.c. to a.c.

Buxton.—Loans Sanctioned.—The Town Council has received sanction to the borrowing of £5,000 for mains and services and £7,000 for the provision of a new plant.

Canada.—Carillon Development.—The *Electrical World* reports that, following a conference with the Premier of Ontario and representatives of the Ontario Hydro-Electric Power Commission, held on October 4th, at Quebec, the Premier of Quebec Province announced that Ontario had come to an agreement regarding the terms under which the Carillon Falls on the Ottawa river will be developed. A contract is to be signed with the National Hydro-Electric Co., which possesses rights to lease the site, and work will commence without delay. A clause forbidding the export of electricity to the United States will be inserted in the contract. The Aldred-Shawinigan group will make the necessary arrangements for the development to be carried out by the private interests concerned, and will also dispose of the power when it is developed. The Ontario Hydro-Electric Power Commission, which will be the first authority to take a supply, will receive over 100,000 h.p.

Caterham.—Hospital Supply.—The Metropolitan Asylums Board has arranged to take a supply of electricity for the Caterham Mental Hospital from the Urban Electric Supply Co., Ltd., at 3½d. per kWh for lighting and 1½d. per kWh for power.

Clayton (Yorks.).—Electricity Supply.—The Electricity Commissioners have given notice of their intention to make a Special Order authorising the Urban District Council to supply electricity within its area. This is a sequel to the recent withdrawal of applications by the Bradford Corporation and the Electrical Distribution of Yorkshire, Ltd., under agreement with the Council.

Clitheroe.—Electricity Scheme.—Good progress is being made with the electricity scheme for the district. At the new transformer station two transformers will be installed, but provision is made for six. The Corporation has already secured powers to supply Chatburn. The charge for electricity will be 6d. per kWh for lighting, and 1½d. per kWh for cooking or domestic power. There are special terms for window lighting after business hours and for large power users.

Chile.—Hydro-Electric Development.—A contract has been concluded for the erection of a 32,000-h.p. power station. The plant will be erected near Los Lagos, and the power will be transmitted thence to Valdivia, and to a steel plant to be erected at Corral. The power station will eventually be extended so as to provide 120,000 h.p. The organisers are the Electro-Siderurgical and Industrial Company, of Valdivia.—*Reuter's Trade Service* (Valdivia).

Continental.—France.—At the recent annual meeting of the Compagnie Electrique du Nord it was reported that a new 5,000-kVA transformer has been added to the power station at Beautor. New 45,000-V transmission lines have been completed between Valescourt and Montdidier and between Laon and Soissons. Work is also in hand on the establishment of a 45,000-V line between Chaulnes and Roye. The company has now over 340 miles of 45,000-V transmission lines and 630 miles of 15,000-V lines in operation.

Belgium.—The Société de l'Electricité de la Region de Malmedy, which was formed last year to utilise the available water power in the Warche district, near the town of Malmedy, is engaged on the construction of a power station at Robertville, where four sets of 5,000-h.p. turbines and generators are to be installed. Further plants are to be constructed at later dates at Butgenbach and Warche.

Eastbourne.—Loan.—The Corporation Electricity Committee is seeking sanction to a loan of £15,000 for electricity extensions.

Extension of Supply.—The Committee is to give a supply of electricity to Langley at an estimated cost of £1,830. Negotiations are proceeding with the Weald Electricity Supply Co., regarding the suggested supply of electricity to Hailsham, and a report is being prepared regarding proposals for extending the supply to Polegate, Stone Cross, Westham and Pevensey, where building developments are taking place.

Halifax.—Hospital Supply.—The Board of Guardians has decided to discontinue its own generation of electricity for lighting at St. Luke's Hospital, and to enter into an agreement for a supply from the Corporation for five years. The annual consumption at the hospital has been about 25,000 kWh, costing an average of 3.37d. per kWh. Under the new scheme it will cost a little over 2½d. per kWh. The cost of the change-over, including repairing of wiring, is estimated at £1,500.

Hamilton.—All-Electric Houses.—The Town Council has adopted the recommendation of the Electric Lighting Committee that four houses being erected by the Council shall be "all-electric."

Hire-Purchase System.—The Engineer has submitted a proposal for the adoption of hire-purchase agreements for wiring premises and supplying domestic apparatus.

Irish Free State.—Bray (Co. Wicklow).—The Urban District Council has decided to reduce the charge of electricity from 9d. to 8d. per kWh.

Lanark.—Street Lighting.—The Town Council has remitted to a committee for consideration and report a proposal to light the streets by electricity.

London.—St. Pancras.—The Borough Council has received sanction to a loan of £3,420 for mains, and the Finance Committee has recommended that application be made for sanction to a further loan of £56 455 for the installation of additional plant and extensions of mains and services.

Shoreditch.—The Lighting Committee has recommended to the Borough Council that application be made to the Electricity Commissioners for sanction to a loan of £18,475 for the following purposes:—One 1,500-kW converter, &c., at Evelyn Street sub-station, £9,575; e.h.p. feeder between Whiston Street and Evelyn Street, £7,550; e.h.p. switchgear, £1,350.

Bermondsey.—The Borough Electricity Committee has decided to carry out mains extensions at a cost of £4,448.

Hackney.—The Finance Committee has recommended to the Borough Council that application be made for sanction to a loan of £15,000 for the following purposes:—Meters, £7,000; services, £6,000; feeder pillars, £2,000.

Market Bosworth.—Opposition to Bill.—At a recent meeting of the Rural District Council it was decided to oppose the Bill being promoted by the Leicestershire and Warwickshire Electric Power Co., for powers to supply electricity in the area, on the grounds that the charges would be excessive, there was no time limit for the commencement of supply, and that no provision was made for the protection of the bridges in the district. It was decided to ask the Pooley Hall Colliery Co. to extend its lighting area to Market Bosworth. The company's terms were 6d. per kWh for lighting, 2d. per kWh for power, and 1½d. per kWh for domestic purposes, and it was prepared to give a supply within ten months.

Mexico.—Hydro-Electric Development.—Application has been made by the Compañia Agricola y de Fuerzo Electrica, of Chihuahua, for permission to extend its hydro-electric works at La Boquilla. The present installation consists of a large dam and reservoir erected in 1924, and four turbo-generators, each of 9 000 h.p. These being insufficient to supply the electricity demanded, the company proposes to build another dam, on the Rio Conchos below La Boquilla. The second station is expected to provide a further 4,000 h.p. The scheme has been entrusted to a Canadian corporation which has constructed several other important dams and reservoirs in Mexico.—*Reuter's Trade Service* (Chihuahua).

North Wales and South Cheshire Electricity Authority.—According to the *North Wales Weekly News*, the quarterly meeting of the North Wales and South Cheshire Electricity Authority was held recently at Llandudno. The Authority was asked by the North Wales Power Co. to approve of arrangements made between the company and the electricity distributors of North Wales for mutual assistance with regard to the giving and taking of supplies of electricity. The matter was referred to the General Purposes and Finance Committee, with power to act. The report of the North Wales Power Co., Ltd., on construction, showed that considerable progress had been made with the construction of transmission lines. The construction of the line between Rhuddlan and Denbigh had been commenced and it was hoped to commence the construction of the lines to Old Colwyn at an early date. With regard to the main dam at Maentwrog, the work had reached a satisfactory stage, and it was anticipated that the fitting of the outlet pipes would be carried out at an early date. Considerable progress had been made with the construction of Gyfynys Hendre Mur and Trawsfynydd dams. Delay in the provision of the second line to ensure continuity of supply to the Wrexham area is being caused by the difficulty experienced in obtaining the last wayleave required for the line from Legacy to Crewe. Delays are also being experienced in regard to the construction of the line from Legacy to Ruabon owing to opposition by local farmers. The Authority passed the following resolution: "That in cases where difficulty is being experienced in obtaining wayleaves for the erection of transmission lines, the Electricity Commission be urged to put compulsory powers into operation at the earliest possible date."

Padiham.—Electricity Supply.—The generation of electricity in the town has commenced. The new power station of the Lancashire Electric Power Co. has been completed, and four areas—Sabden, Read, Whalley and Simonstone—are now being supplied with electricity. The station is expected to be giving a full supply by the close of this year.

Portsmouth.—Loan Sanctioned.—The Electricity Committee has obtained sanction to the borrowing of £7 000 for works in connection with the supply of electricity to the added area.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

EGHAM AND STAINES.—Lighting: An increase of ¼d. per kWh.

SMETHWICK AND OLDBURY.—*The Shropshire, Worcestershire, and Staffordshire Electric Power Co.*—Lighting and domestic supplies: An increase of 7½ per cent.

WILLESDEN.—An increase of ¼d. per kWh.

EDINBURGH.—Lighting: An increase of ¼d. per kWh. Power and domestic heating: An increase of 1/5d. per kWh.

KIDDERMINSTER.—*The Kidderminster Electric Lighting and Traction Co., Ltd.*—Lighting and general domestic supplies: An increase of 7½ per cent.

ASHTON-UNDER-LYNE.—An increase of ¼d. per kWh.

Richmond (Yorks.).—INAUGURATION OF SUPPLY.—The electricity supply for the district was formally inaugurated by the Mayoress on October 22nd.

Seaton.—ELECTRICITY SCHEME.—The note which appeared in our issue of October 15th under this heading referred to Seaton, near Workington, Cumberland.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the National Electric Construction Co., Ltd., to supply electricity in the urban district of Holbeach and the Stepney Borough Council to acquire land at St. George-in-the-East for the erection of a transformer station.

Sunderland.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £20,000 for services.

Swansea.—PROPOSED NEW POWER STATION.—The Corporation has received a report from the Electricity Committee recommending the erection of a new power station at Ynystawe. Consideration of the scheme has been deferred, and a deputation has been appointed to wait upon the Electricity Commissioners to discuss the position of the Corporation's electricity undertaking and its development in the Amman Valley, and to obtain guidance as to its future policy.

Wallasey.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. B. T. Hawkins) for the year ended March 31st last record a total income of £123,108, as compared with £124,826 in the preceding year. Working expenses amounted to £66,820, as against £66,127, leaving a gross profit of £56,280 (£58,699). After deducting capital charges there was a net surplus of £22,952, as compared with £31,497 in 1924-25. A contribution of £9,000 was made to the borough fund. The capital expenditure during the year amounted to £49,982, and included £18,741 for machinery and plant, and £17,457 for mains, services, and transformers. The electrical energy sold increased from 18,467,537 to 20,050,270 kWh., and the maximum supply demanded from 6,550 to 7,000 kW.

Wrexham.—MAINS EXTENSIONS.—The Town Council has decided to carry out mains extensions at a cost of £3,350.

Tramway and Railway Notes.

Bradford.—TRAMWAY MANAGER'S REPORT.—According to *Modern Transport*, following the request of the City Council to its Tramway Committee to give an opinion on the whole question of passenger transport, the tramway manager (Mr. R. H. Wilkinson) has prepared a report on the subject, in which he states he would not advise deciding upon any future policy for the existing tramway routes, but would deal on its merits with each year's programme of renewals as it arises. Continuing, Mr. Wilkinson says that, while the motor-'bus has many advantages in its favour, it cannot transport large numbers of passengers as economically, efficiently, and as safely as the tramcar, and any attempt to introduce it for carrying heavy traffic would be commercially and practically unsound.

Cardiff.—TRAMWAY IMPROVEMENTS.—The Corporation is applying for powers to extend the tramway from various termini in the borough, at an estimated cost of £30,000.

Continental.—SWITZERLAND.—It is expected that by the end of the present year about 660 miles of the State railway system will have been electrified. It is scheduled that another 278 miles will be completed during 1927, including the Palezieux-Berne, Rothkreuz-Brugg, Winterthur-Rorschach, Yverdon-Biel, Olten-Biel, and Richterswil-Buch sections. Thus, by the end of next year 938 miles of the Swiss railways, or about half the State system, will have been converted to electric traction. A further sum of approximately £160,000 is to be expended next year on the Vernayaz hydro-electric power station; a sum of £232,000 is also provided in the State Railway Budget for 1927 for additional electricity transmission lines; £248,000 for new transformer stations; and approximately £268,000 for l.p. installations.

BELGIUM.—The Société des Tramways Bruxellois has decided to convert a number of its lines in the Brussels district from the old conduit to the overhead system. It has also secured a concession for an extension of the lines between Anderlecht and Laeken to Neder-over-Heembeek.

SPAIN.—A new electric tramway has just been completed and opened for traffic between Vigo, Romallosa, and Bayona, a distance of about 12¼ miles.

AUSTRIA.—The local steam railway between Schonbrunn and Konigsberg, which was recently acquired by the Vereinigte Electricitäts Gesellschaft, of Vienna, has recently been electrified.

London.—THROUGH-RUNNING.—The Highways Committee of the L.C.C. has recommended that the through-running arrangements with the Croydon Corporation from London to Purley, in accordance with the agreement entered into on April 7th, 1926, be continued on the understanding (i) that the Croydon Corporation will, before January 1st, 1927, place an order for ten cars to be delivered under penalty at the earliest possible date, and (ii) that, unless the Corporation, before January 1st, 1928, places a further order for 15 additional cars, the existing arrangements for through-running between London and Purley shall terminate on December 31st, 1927.

RAILWAY ELECTRIFICATION.—In a recent speech Sir Herbert Walker is reported by the *Financial News* to have said that the electrified portion of the Southern Railway had during the first four months of this year shown a traffic increase of 15 per cent., the receipts from which, after allowing for the interest on capital outlay and the increased cost of working, afforded a margin of profit. He was satisfied that electricity was going to be the solution of the difficulties of the railway world.

Manchester.—TRAMWAY IMPROVEMENTS.—The Corporation Tramways Committee proposes to lay a loop line in Cannon Street and Church Street.

Southend-on-Sea.—RAILLESS CARS.—At a recent meeting of the Town Council, the town clerk submitted a letter received from the Ministry of Transport with regard to the railless cars on the Prittlewell route to Priory Park, stating that the Ministry did not desire to raise any objection to the working of the vehicles being continued pending statutory authority being obtained. The town clerk reported that the Council had negatived the Light Railways and Lighting Committee's recommendation that railless cars be provided on the Leigh route from Chalkwell Park gates to the Leigh tram terminus, but had adopted route "A," *i.e.*, the existing section from Victoria Circus to the Priory. The Law and Parliamentary Committee was authorised to take the necessary steps to obtain a Provisional Order authorising the use of railless cars on this route.

Telegraph and Telephone Notes.

Austria.—TELEPHONE SYSTEM.—There were 124,437 telephones in use on the principal telephone systems of Austria at the end of 1925. Vienna had almost 80 per cent. of this number. The equipment in Linz, Graz, and Vienna (with the exception of one suburban exchange in the latter) is automatic; Neustadt, St. Poeltem, Moedling, and Salzburg have systems in which both manual and automatic control is used.

Europe's Telephone System.—GROWTH MAINTAINED.—The returns of the chief European telephone administrations for 1925 show an average increase of about 8 per cent. The returns for several States (Denmark, Italy, Spain and Poland, among others) have not yet been received, but without them the increase over the total at the close of 1924 is 495,000, and will probably reach 550,000 when the returns are complete. Great Britain's share of this excess over the 1924 figures is 115,632, or at the rate of 9 per cent.; the rate of increase in America during the same period was 4.8 per cent., and in Canada 6 per cent. It should be pointed out that the increase in the United States was on a total of between 15 and 16 millions, or about two-thirds of the entire number of telephones in the world; while the 9 per cent. increase for Great Britain was on about 1,250,000 telephones. New York City alone increased its telephones by 118,000 thus passing Great Britain's total increase by more than 2,000, and started 1926 with a total of 1,415,000 telephones.

France.—AUTOMATIC TELEPHONY.—It is reported from Paris that the company, whose apparatus has been definitely adopted for the new automatic telephone installation in Paris, has concluded an arrangement with the Société des Etablissements Grammont of that city for the manufacture of part of the necessary apparatus.

NEW LINES.—A considerable extension of the long-distance telephone system of the country is at present in progress in France. Of the lines which were deemed of primary urgency, several have already been completed. The programme of "second urgency" lines includes a second cable between Paris and Belgium. The majority of the new lines are being constructed for the French Government by the Société d'Etudes pour Liasons Telephoniques et Telegraphiques a Longue Distance (S.E.L.T.), which was formed in 1920 under the auspices of three French concerns (La Société Industrielle des Telephones, La Société des Etablissements Grammont, Paris, and La Société Alsacienne de Constructions Mecaniques, of Belfort), each of which has a telephone cable factory. The S.E.L.T. has established a laboratory in which experiments are being conducted to draw up specifications for the most suitable types of cables, coils and amplifying relays for the different lines. The latter are being made by the Société Industrielle des Telephones and the Grammont Co., and the Pupin coils by the Alsacienne concern.

India.—Trunk Telephony.—Trunk telephone communication has, according to *Indian Engineering*, been established between Mussoorie and the principal stations in Bombay, Punjab, and the United Provinces circles, as far as Bombay, Peshawar, and Benares respectively.

Marine Radio Service.—Marconi Agreement.—The Marconi International Marine Communication Company states that it has recently come to an arrangement with its principal competitor, the Radio Communication Company, and that it should enable both companies to effect substantial reductions in expenditure and to improve the service to shipowners. Each company will continue to develop and supply its own types of marine equipment.

Pacific Cable Board.—London Meeting.—A meeting of the Pacific Cable Board was convened by Mr. Amery, Colonial Secretary, in London on October 19th, and was attended by the Dominion Premiers, who are taking part in the Imperial Conference. Other meetings have taken place since.

Russia.—Telephone Service.—The Soviet Government lately issued a report on the position of the telephone system of Russia at the end of October, 1924. It shows that at that date there were 533 telephone exchanges in the country, with a total of 121,275 subscribers, the length of the telephone cables in use being 693,750 miles, and of wires lines 157,100 miles.

Spain.—Automatic Telephony.—An urban automatic telephone system has just been completed and put in operation in the Santander district of Spain by the Compania Telefonica Nacional de Espana.

The Telephone Service.—Anglo-Swiss Service.—A direct Anglo-Swiss telephone service, without intermediate switching in France, is to be provided by the extension to Switzerland of two or three circuits in the latest Anglo-French telephone cable. It is hoped that the service will be available early in the New Year.

Wireless on Board Ship.—Operators' Regulations.—M. Vanthaaf, an Inspector of Navigation, Holland, has been in London conducting unofficial negotiations with the Board of Trade with regard to the regulations governing the employment of wireless operators on board commercial vessels, particularly with a view to their safety. Any change in the regulations would entail eventually the revision of the treaty which was concluded shortly after the *Titanic* disaster for the greater safety of shipping.—*Reuter* (The Hague).

Radio Notes.

Czecho-Slovakia.—New Station.—The new Pressburg (Bratislava) station will begin operations on November 1st, using a wavelength of 300 metres. There are 4,000 registered listeners in Pressburg town, and 1,400 more in the surrounding district. The announcer will be a woman.

The Broadcasting Commission.—Appointments Completed.—The Broadcasting Commission, which is to take over control of broadcasting from the B.B.C. in January, has been completed by the inclusion of Dr. Montague Rendall, until 1924 headmaster of Winchester. The four other members of the Commission, as announced in Parliament, are Lord Clarendon, at present Under-Secretary for the Dominions (chairman); Lord Gainford, now chairman of the B.B.C.; Mrs. Philip Snowden, wife of the Socialist ex-Chancellor of the Exchequer; and Sir Gordon Nairne, director and late Comptroller of the Bank of England. It is understood that the members of the Commission will hold office for five years and will receive salaries. Lord Clarendon's salary as chairman will be £4,000 a year.

Parliament met on October 25th and 26th and Sir Wm. Mitchell-Thomson, Postmaster-General, announced that there would have to be a supplementary estimate for the payment of the salaries of this body, and the most convenient opportunity for a Parliamentary discussion would be on the estimate. No expenditure would be incurred, nor salaries paid, before the estimate had been passed.

Uruguay.—Station Tenders.—The Government of the Banda Oriental has invited tenders for the erection of a new station near Montevideo for broadcasting. Tenders should be addressed to Señor Gilberto Lasnier, Director of the Radio Communication Service, Montevideo, Uruguay.—*Reuter's Trade Service* (Montevideo).

United States.—New Stations.—The Department of Commerce continues to grant licences for new stations. Five were announced recently within one week, and the total for the country is now close to 600. *World Radio* wonders where wavelengths are found for them all. Fortunately, some of the stations are inactive and others "go on the air" only at fixed intervals, or on special occasions.

Venezuela.—New Station.—A broadcasting station has been erected at Caracas and put into use. The range of the station, designated AYRE, is 2,000 miles. Preliminary tests have proved that signals can be heard in many of the large towns of the Republic, in some parts of the neighbouring State of Colombia, and as far as the West Indian islands of Trinidad, Barbados, and Puerto Rico.—*Reuter's Trade Service* (Caracas).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Adwick-le-Street. — November 10th. Urban District Council. Internal wiring 264 Council houses. (See this issue.)

Atherton.—November 2nd. Urban District Council. 2,350 yd. h.p. cable. (October 22nd.)

Bradford.—November 13th. Tramways Committee. Stores required during 12 months, commencing January 1st, 1927, including electrical fittings for tramcars (Sch. No. 3), insulated bolts and controller contacts (Sch. No. 7). Schedules and forms of tender from Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Cardiff.—November 22nd. Electricity Department. One water-tube boiler, mechanical stokers, and forced-draught plant; steel chimney and grit-collecting plant; induced-draught plant. (See this issue.)

Dublin.—November 8th. Dublin United Tramways Co. (1896), Ltd. Stores for 12 months, including electric lamps, electrical fittings, &c. (October 22nd.)

Eastbourne.—November 5th. Electricity Department. One water-tube boiler, economiser, feed heaters, two steel chimneys with induced-draught plant, interconnecting pipework, &c. (October 8th.)

Egypt.—Cairo.—Egyptian State Railways, Telegraphs and telephones. Chief Inspecting Engineer in London, Queen Anne's Chambers, Broadway, Westminster, S.W.1. 1,500 3-way switchboard cords, 1,000 3-way plugs for switchboard.—*Reuter's Trade Service* (Cairo).

Glasgow.—October 30th. Corporation. Electric lighting installations at Duke Street and Govanhill rehousing schemes. Specifications, &c., from Mr. R. B. Mitchell, Corporation electrical engineer and manager, 75, Waterloo Street.

India.—November 1st. India Store Department. 5,000 yd. armoured cable. (October 22nd.)

280 miles (approx.) 110,000-V overhead transmission line. (See this issue.)

London.—Metropolitan Asylums Board.—November 3rd. Installation of automatic telephones and fire alarms and alterations to electric lighting installation at the North-Eastern Hospital, St. Anne's Road, Tottenham, N. (October 22nd.)

Paddington.—November 19th. Great Western Railway. Stores, including telegraph instruments, electrical apparatus, electrical wires and cables, &c. (October 22nd.)

Leyton.—November 19th. Urban District Council. Installation of electric lighting and a central heating system at Knotts Green Special School. (See this issue.)

New Zealand.—Wellington.—December 7th. Public Works Department. Induction regulator. (B.X. 2935.)*

January 4th, 1927. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*

January 18th, 1927. Transmission line steel towers for Waikaremoana power scheme. (A.X. 3732.)*

February 1st, 1927. Storage battery and booster for Waikaremoana. (B.X. 2937.)*

December 15th. Government Railways. Switchgear, cable, motor-generator sets, junction boxes, &c., for the Hutt Valley locomotive workshops. (B.X. 2949.)*

Post and Telegraph Department. December 6th. Key switches.* (B.X. 2962.)*

Salford.—November 6th. Board of Guardians. Wiring, fittings, &c., for new mortuary and converted laundry buildings at Union Infirmary, Hope, Pendleton. Specifications from Mr. E. H. Inchley, clerk to Board of Guardians, Poor Law Offices, Eccles New Road.

Skipton.—November 5th. Electricity Department. Supply and laying of 500 yd. of cable. (See this issue.)

Stoke-on-Trent.—November 10th. Electricity Department. E.h.p. switchgear for central power house, e.h.p. switchgear and moulded stone for Stoke sub-works, and neutral earth resistance for central power house. (October 15th.)

E.h.p. and l.p. totally-enclosed ironclad switchgear. (See this issue.)

November 10th. Electricity Department. Coal and ash-handling plant for the Central Power House, Hanley. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Adwick-le-Street.—Urban Council.

Extension of contract, to include the lighting of the whole of the park at Woodlands, at an estimated additional cost of £550.—Callender's Cable & Construction Co., Ltd.

Barnes.—Urban Council. Accepted:—

800 yd. distributor cable (£347).—Macintosh Cable Co., Ltd.

Barnsley.—Electricity Committee. Accepted:—
Turbine oil purifier (£80).—De Laval, Chadburn & Co., Ltd.

Bexhill.—Electricity Committee. Accepted:—
2½-amp. prepayment meters.—Ferranti, Ltd.
Cable (£154).—Enfield Cable Works, Ltd.

Bradford.—Electricity Committee. Accepted:—
Two 200-kVA transformers.—Foster Engineering Co.
Two 200-kVA ditto.—Yorkshire Electric Transformer Co., Ltd.
Four 300-kVA ditto.—British Electric Transformer Co., Ltd.
Four 600-kVA ditto.—Hackbridge Electric Construction Co., Ltd.

Glasgow.—Tramways Committee. Accepted:—
Copper bond.—Thomas Bolton & Sons, Ltd.
Block tin.—P. & W. M'Lellan, Ltd.
Brass spelter.—J. Allan & Co.

Government Contracts.—The following contracts were placed by Government departments during September:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Electric cable.—British Insulated Cables, Ltd.; Enfield Cable Works, Ltd.; St. Helens Cable & Rubber Co., Ltd; General Electric Co., Ltd.; Johnson & Phillips, Ltd.; W. T. Glover & Co., Ltd.
Ships' fans.—Newton Dynamo Works.
Table fans.—General Electric Co., Ltd.; Veritys, Ltd.
Lamp fittings.—General Electric Co., Ltd.; W. McGeoch & Co., Ltd.
W.t. panels.—H. W. Sullivan, Ltd.
Plugs and sockets.—Edison Swan Electric Co., Ltd.
Starters and resistances.—Watford Electric Mfg. Co., Ltd.

WAR OFFICE.
Electric cable.—Johnson & Phillips, Ltd.
Cable drums and stands.—Ruston & Hornsby, Ltd.
Electric lighting fittings.—Cable Accessories Co., Ltd.
Generating set.—Ruston & Hornsby, Ltd.
Mercury-arc rectifier equipment.—Hewittic Electric Co., Ltd.
Electric lighting switches.—General Electric Co., Ltd.
Power-driven trucks.—Greenwood & Batley, Ltd.
Electric lighting installation (Gravesend Barracks).—Burch & Verture.

AIR MINISTRY.
Accumulators.—Chloride Electrical Storage Co., Ltd.
Lifts (Halton).—J. Stannah.
Generators (Abu Sueir).—Mirrlees, Bickerton & Day, Ltd.
Underground cable.—Watsahms, Ltd.
Repair of ignition spares.—Delco-Remy & Hyatt, Ltd.
Navigation and identification lamps.—Howes & Burley, Ltd.
Magnetos and spares.—Scintilla, Ltd.
Sparking plugs.—Robinhood Engineering Co., Ltd.
Telephone-t legraph installations (Persian Gulf).—Marconi's Wireless Telegraph Co., Ltd.
Transmitters.—Gambrell Bros., Ltd.; Johnson & Phillips, Ltd.

POST OFFICE.
Cable (manufacture, supply, drawing in and jointing).—Glasgow-Paisley: Johnson & Phillips, Ltd.; Caerphilly-Hengoed: Callender's Cable and Construction Co., Ltd.
Switchgear (e.h.p., d.c.) (Rugby).—General Electric Co., Ltd.
Telephone exchange equipment.—Carlisle: Siemens Bros. & Co., Ltd.; East Finchley: General Electric Co., Ltd. (sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machines); Streatham and Tottenham: Standard Telephones & Cables, Ltd.; Weston-super-Mare: Automatic Telephone Mfg. Co., Ltd.; Colne (Lancs): Ericsson Telephones, Ltd.; Droylesden Co-operative Society (Manchester), United Dairies, Ltd. (W.2), W. Crawford and Sons, Ltd. (Liverpool), International Combustion, Ltd. (W.C.2), Barrow, Hepburn & Gale (S.E.1), and Castner-Kellner Alkali Co., Ltd. (Runcorn): Relay Automatic Telephone Co., Ltd.
Telephone repeater station (2-wire equipment).—Catterick and Leeds: Standard Telephones & Cables, Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works; Standard Telephones and Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.
Testing, protective and miscellaneous apparatus.—Walter Jones & Co.; Power Equipment Co., Ltd.
Battery stores.—Accumulators of Woking, Ltd.; Tudor Accumulator Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones and Cables, Ltd.
Loading coils.—General Electric Co., Ltd.
Telephone cords.—Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.
Lamps.—A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.
Jointing sleeves.—C. M. Powell Bros.
Cadmium copper wires.—T. Bolton & Sons, Ltd.
Copper, enamelled and silk-covered wire.—Concordia Electric Wire Co., Ltd.

CROWN AGENTS FOR THE COLONIES.
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Conduit.—Key Engineering Co., Ltd.
Shovelling materials.—Tyer & Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.; A. Reyrolle & Co., Ltd.; Metropolitan-Vickers Electrical Export Co., Ltd.
Radio apparatus.—Siemens Bros. & Co., Ltd.
Wire, &c.—British Insulated Cables, Ltd.

H.M. OFFICE OF WORKS.
Wiring installations.—Admiral House: Electrical Installations, Ltd.; Industrial Museum: Commercial Telephone & Electrical Co., Ltd.
Converting plant (N.P.L.).—British Thomson-Houston Co., Ltd.
Cable, wire, &c.—Edison Swan Cables, Ltd.; Ward & Goldstone, Ltd.

Grimsby.—Electricity Committee. Recommended:—
Trenching and filling (£569).—Jackson & Cater.

Tramways Committee. Recommended:—
Two trolley vehicles (£1,475 each).—R. Garrett & Sons, Ltd.
Wiring tram depôt in Victoria Street (£110).—T. Dickinson.

Glasgow.—Corporation.
Electric lighting, &c., Meanskirk Sanatorium.—Kennedy, Stark & Co.
Main supply cables.—J. Brash & Son.

Hull.—Tramways Committee. Accepted:—
Electrodes.—Quasi-Arc Co., Ltd.

London.—METROPOLITAN ASYLUMS BOARD.
Installation of battery charging plants at five ambulance stations:—

T. Clarke & Co., Ltd. (Recommended)	**£398**
V. G. Middleton & Co., Ltd.	396
Riddle & Goddard, Ltd.	485
Tee & Wiseglow	476
Read & Partners, Ltd.	506
G. E. Taylor & Co., Ltd.	516

ST. PANCRAS.—Contracts and Stores Committee. Recommended:—
3,200 yd. l.p. cable (£770), Hackbridge Cable Co., Ltd.; 3,140 yd. do. (£2,323), Siemens Bros. & Co., Ltd.; 3,530 yd. do. (£783), Standard Telephones and Cables, Ltd.; 800 yd. do., Pirelli-General Cable Works, Ltd.

HAMMERSMITH.—Electricity Committee. Accepted:—
Alteration to powdered fuel plant blowers (£170).—J. Gardner & Co., Ltd.

L.C.C. Education Committee. Accepted:—
Wiring the enlarged Hackney Institute:—

Bailey & Incledon	1,899
Commercial Telephone and Electrical Co., Ltd. (Accepted.)	**£1 952**
C. Mortlock, Ltd.	1,983
Morris Electrical Co., Ltd.	2,025
Alpha Manufacturing and Electrical Co., Ltd.	2,150
J. M. Connare	2,478
A. Hawkins & Sons	2,675
A. V. Gifkins & Co., Ltd.	2,718
Jacob, White & Co., Ltd.	3,167
Collins Electrical, Ltd.	3,540
Borough of Hackney (Electricity Dept.)	4,138

Installation of new machines and electric motors at Brixton School of Building (£277).—Electromotors, Ltd. (Accepted.)

BERMONDSEY.—Baths Committee.
60-kW motor-generator and accessories for the New Grange Road baths:—

Metropolitan-Vickers Electrical Co., Ltd.	£482
General Electric Co., Ltd.	470
Lancashire Dynamo and Motor Co., Ltd.	458
English Electric Co., Ltd. (Accepted.)	445

STEPNEY.—Electricity Committee. Recommended:—
50 tons pitch (£412).—Forbes, Abbott & Lennard, Ltd.
Conduit, fittings, and distribution boards (£654).—Catchpole & Co.
25,160 yd. C.M.A. V.I.R. cable (£313).—W. White & Co.

Preston.—Electricity Committee. Recommended:—
Cables (£1,615).—British Insulated Cables, Ltd.

Salford.—Electricity Committee. Accepted:—
2,000 yd. e.h.p. cable (£829); 2,000 yd. l.p. ditto (£233); 7,000 yd. l.p. ditto (£1,836).—N.V. Nederlandsche Kabelfabriek, Delft, Holland.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—
Cable ducts (£437).—Donis & Soper.
Low-pressure switchgear (£1,671).—Statter & Co.
Battery plates, 15 groups (£201).—Sauler & Franks, Ltd.; 10 groups (£126).—A. Vaux, Ltd.
Equipment for ash-conveyor (£900).—Babcock & Wilcox, Ltd.
High-speed circuit breakers (£765).—Reyrolle & Co., Ltd.
Regulators and coupling parts (£486).—South African General Electric Co., Ltd.

Thame.—Board of Guardians.
Installing electric light at the Institution:—

Holland, Beachey & Co. (Accepted.)	**£248**
Messrs. Dove	225
Hawk Garage, Aylesbury	244
Mr. Ostler	267

Forthcoming Events.

Society of Technical Engineers.—Friday, October 29th. At the Queen's Hotel, Birmingham. At 7.30 p.m. Address on "The Engineering Bill," by Mr. R. Hazleton.

Junior Institution of Engineers.—Friday, October 29th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Distortion in Wireless Reception," by Mr. A. V. Balthatchet.
Friday, November 5th. Lecturette on "Mast Erections," by Mr. C. H. Woodfield.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 29th. At the Literary and Philosophical Society, Newcastle-on-Tyne. At 6 p.m. Paper on "How Should an Engineer be Trained?" by Sir Theodore Morison.

Faraday House Old Students' Association.—Friday, October 29th. At the Hotel Cecil, Strand, W.C. At 6.30 p.m. Annual dinner.

Finsbury Technical College Old Students' Association.—Saturday, October 30th. At the Engineers' Club, Coventry Street, W. Annual dinner.

Society of Engineers.—Monday, November 1st. At Burlington House, W. At 5.30 p.m. Paper on "Some Products of a Small Machine Shop," by Miss A. Ashberry.

Institute of Transport.—Monday, November 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Annual general meeting.

Roentgen Society.—Tuesday, November 2nd. At the British Institute of Radiology, 32, Welbeck Street, W. At 8.15 p.m. Paper, "Research in Radiology," by the President.

Royal Institution.—Tuesday, November 2nd. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Acoustics of Public Buildings," by Dr. G. W. C. Kaye.

National Association of Supervising Electricians.—Tuesday, November 2nd. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Paper on "Hot Water Supply," by Mr. C. G. Nobbs.

Edinburgh Electrical Society.—Thursday, November 4th. At the Royal Scottish Society of Art, 117, George Street. At 8 p.m. Paper on "Suction-cleaning Machinery and Application," by Mr. A. B. Davis.

Institution of Electrical Engineers.—Thursday, November 4th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Design of City Distribution Systems, and the Problem of Standardisation," by Messrs. J. R. Beard and I. G. N. Haldane
(Wireless Section).—Wednesday, November 3rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Inaugural address by the Chairman, Prof. C. L. Fortescue.
(North-Western Centre).—Tuesday, November 2nd. At the Midland Hotel, Manchester. At 7.30 p.m. Address by the Chairman, Mr. W. J. Medlyn, to be followed by a smoking concert.

Institution of Mechanical Engineers.—Friday, November 5th. At the Institution, Storey's Gate, S.W. At 6 p.m. Thomas Hawksley Lecture on "Elasticity and Plasticity," by Prof. E. G. Coker.

Electrical Power Engineers' Association (Southern Division).—Friday, November 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Televisory Remote-control Substations," by Mr. C. I. Shuttleworth.

Association of Mining Electrical Engineers.—Saturday, November 6th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Paper on "Protection of A.C. Systems against Short Circuits," by Mr. E. I. David.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Eltax torch batteries.
Rotex electric signs.

Notes.

Birmingham Electric Club.—The annual ladies' evening of this club was held on Friday last, at the Grand Hotel, Birmingham. It took the form of a ball, with the addition of a whist drive for non-dancers. Approximately 350 guests participated, and the evening was a great success. The Grosvenor Room and the adjoining Lounges were specially illuminated under the direction of the lighting experts of the General Electric Co., Ltd., and Metro-Vick Supplies, Ltd., with the assistance of Messrs. E. Hill & Sons. The natural beauties of the Grosvenor Room were thrown into prominence by the use of fairy lamps outlining the architectural features. Flood lighting, spot lighting, &c., in varied shades adapted to the dances were used, and in addition the floral decorations were very tastefully carried out, especially those of the band-stand, which, with the addition of special colour-screen lighting, was very effective. Music for dancing from 7.30 p.m. to 2 a.m. was provided by Jack Venables' Cabaret Band.

Appointments Vacant.—Two charge engineers (£595) for the Municipal Commissioners of Singapore. Chief clerk (£400), lady showroom demonstrator (£3) for the Rotherham Corporation Electricity Department. Meter assistant (£3 10s. per week) for the Inverness Corporation Electricity Department. Engineer-in-charge at poor-law institution for the Watford Board of Guardians. Four charge engineers, one meter and testing assistant, and one assistant controller of stores, for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

The Manchester Dance.—The Manchester Electrical Engineers' dance will be held at the Midland Hotel, Manchester, on December 3rd. Information may be obtained from Mr. J. Harcourt-Williams, King's House, 42, King Street West, Manchester, the hon. treasurer, or from Mr. George H. Fawcus, 60, Stamford New Road, Altrincham, the hon. secretary.

City Electricity Charges.—The *Daily Telegraph* states that the Corporation of the City of London had before it, on October 21st, a resolution passed at a wardmote of the Ward of Farringdon Within, to the effect that, as the charge for electricity in the City was still greatly in excess of that in the neighbouring boroughs, the Corporation should be asked to inquire why the standard price, which by the Act of 1925 was to be fixed, and to operate from January 1st, 1926, had not yet been notified to consumers. Mr. Alderman Sandle said it was very necessary in the interests of the Corporation and of the citizens that serious attention should be given to the electricity question by their officials. Some rather disquieting announcements from the consumers' point of view had been made of the distribution of bonus shares by London companies during the past week. These were to be paid for by capitalising accumulated reserves, and in one case ordinary shareholders were secured by Act of Parliament for 20 per cent. on their original investments until 1971. That seemed an excessive return on a monopoly public service. So far as the City was concerned, the two companies operating therein had accumulated immense reserves out of the high prices charged during the last seven years. It should be the endeavour of the Corporation to get a large part of those reserves applied to writing down assets, or replacing old plant with up-to-date machinery; otherwise the whole would be capitalised and distributed to the ordinary shareholders, and consumers in the City would pay a handsome interest both on the original and the bonus shares for the next forty-five years. The matter was referred to the Court of Aldermen.

Lectures and Papers.—A lecture entitled "Wireless Valves: Their Application and Characteristics" was given before the Edinburgh Electrical Society on October 14th by Mr. F. E. Henderson (General Electric Co., Ltd.), when the evolution and development of the thermionic valve were illustrated by means of lantern slides, and practical experiments and demonstrations.

Before the West Bromwich Engineering Society, on October 15th Mr. L. W. Wild, M.I.E.E., read a paper on "Electric Resistance Furnaces." The author traced the history of this type of furnace, and dealt with its construction and application.

Northampton Engineering College Engineering Society.—Wednesday, November 3rd, at 5.30 p.m. "Electrical Machinery in Manufacture," by Mr. A. N. D. Kerr.

Electrical Association for Women.—We briefly referred in our last issue to the inaugural meeting of the Manchester branch of the Association, which was held on Tuesday last. Further arrangements are as follows:—November 13th, visit to Agecroft power station; November 22nd, at the Manchester Lighting Service Bureau, lecture on "Lighting in the Home"; December 9th, visit to the Corporation showrooms to witness demonstrations of electric cooking and washing. The provisional programme for next year includes further lectures on the use and replacement of fuses, one on "Electricity Applied to Medicine," by Dr. G. J. Langley, and another on "Running an All-Electric House," by Mrs. Ferranti. In addition, the Singer Sewing Machine Co. is to demonstrate its electrically driven model, and visits are to be paid to the showrooms of the General Electric Co., Ltd., and the works of the Metropolitan-Vickers Electrical Co., Ltd.

On October 20th about 50 members of the Association and others interested in the Industrial Welfare Society paid a visit to the Leyton works of the London Electric Wire Co. and Smiths, Ltd. The party was welcomed by Mr. B. Hawke, works manager, and Mr. G. C. Burnand, sales manager, and after inspecting the works tea was served in the works canteen. Mrs. Hollis thanked the company for an enjoyable afternoon and Capt. Pither supported her on behalf of the Industrial Welfare Society.

On October 7th, a drawing-room meeting of the Birmingham and Midlands Branch took place at the house of Mrs. H. K. Beale, wife of the chairman of the Birmingham Electric Supply Committee: Mr. Francis, of the E.D.A., lectured to a company of about 60, and a demonstration of various electrical appliances was given. An interesting demonstration of electric sewing was given on October 14th to a large gathering of members of the Association, including the president, Lady Brooks, and the vice-president, Mrs. R. A. Chattock, at Ridgeways Café, Birmingham. On the following Thursday, October 21st, at the Queen's Hotel, Birmingham, the members attended a recital, arranged by Mr. Joseph Riley, to demonstrate the Bluthner-Hupfield Reproduction player piano (electrically driven). This was a delightful afternoon. Several other meetings have been arranged for.

Institution of Fuel Economy Engineers.—At the Connaught Rooms, Kingsway, on October 20th, Sir Robert Horne, M.P., was the chief guest at the luncheon of the Institution. Sir Hugo Hirst presided, and introduced the guest as one of the greatest business men in the country. In an address, Sir Robert encouraged the Institution in its work on the advancement of economy in the utilisation of fuel. He could not imagine where economy could produce more inspiring results than in the case of coal, upon which all industrial life in this country was founded, and which was the only source of energy to which we could look for the generation of electricity. In 1924, out of 184,000,000 tons of coal consumed in this country, 147,000,000 tons were used in the raw condition, involving incalculable waste. It had to be said in defence of the coal owners, who were credited with not having been sufficiently enterprising in using coal by the best methods, that this country was as advanced as any other country in this connection. As a caution he pointed out that the accomplishment of beautiful scientific experiments did not mean that the things could be made a commercial success. The experiments in coal economy were not yet sufficiently advanced to attract the confidence of commercial men, and until the stage when the expenditure of capital would produce a dividend was reached we should not have development. He hoped the expectations of the investigators into the question of obtaining oil from coal would be realised. It was dangerous for the country to rely on outside sources for oil in time of war, and an embarrassment in time of peace. The demand for oil would soon outrun the supply; we were importing 1,300 million gallons of oil per year. There was also a great desire to find a smokeless fuel, and it was computed that 3,000,000 tons of unused fuel escaped every year in this country in the form of soot. If the various coal economy theories were sound, the wealth of the country would be added to enormously. There were two main lines on which investigations were proceeding, the production of oil by treating powdered coal with hydrogen, and the low-temperature carbonisation of coal to obtain liquid fuel, and other products, with a residue of solid fuel. There seemed to be infinite possibilities in connection with powdered fuels. Big developments in coal economy seemed to be much nearer than in the direction of harnessing the tides around our coasts. Sir Herbert Blain, in moving a vote of thanks to Sir Robert, referred to the fact that there were two institutions with the same objects. That was a great pity, and meant a division of energies. He hoped good sense would prevail and bring both bodies together.

International Dental Exhibition.—Some idea of the progress made in the application of electricity in the dental profession was obtained from the variety of apparatus seen at the International Dental Exhibition which was held last week at the Imperial Institute, South Kensington. Among some of the most interesting electrical exhibits was a combination cabinet which provides for practically every requirement in dental operations, including very delicate electrically-heated "drilling" appliances, mouth lamps, electrically-heated air syringes, and so on. Most of the attachments are fitted to flexible leads and housed in the cabinet on the pulley principle adopted for the jacks and cords in telephone exchanges. The electrical heating of the instruments is said to be a big advance for the dentist, in that the patient is kept ignorant of the fact that they are heated at all, the knowledge of which usually causes him considerable distraction. The electrically heated air syringe also represents an important advance over the usual bulb device as the air flows in one direction only, outward, thus avoiding the possible collection of germs from the patient's mouth. Various models of such cabinets were exhibited, some including spot-light attachments, specially designed to confine the illumination to the small

area required and to protect the operator from glare, and very small electric fans. An electrically-driven air compressor for the dental surgery was of particular interest. This is an excellent example of workmanship. The small compressor and driving motor, capable of pumping 8 gals. of air at 40-lb. per sq. in. pressure in 3¼ min., is mounted on a steel container fitted with a draw-off water tap. The compressor works automatically, maintaining a pressure in the tank of between 30 and 40 lb. per sq. in. X-ray apparatus, specially designed for dental use, was also included in the exhibits. In one self-contained model a small cabinet at the back of the chair houses the necessary transformers and filament regulating-resistance in a very compact manner, and the tube is held in bakelite supports by an aluminium bracket so constructed, with angle gauges at the joints, that any photograph may be taken to represent the exact position and dimensions of a former one. Most of the dental X-ray equipment is designed for 3-in. penetration. Other particularly good examples of workmanship seen were some small motors driving the dental "engines." These are subjected to very severe trials in almost immediate stopping and starting. The commutator of one motor which was seen demonstrated was assembled under a pressure of 500 tons. Centrifugal lubrication is provided for this apparatus. An interesting range of armatures for very small motors for various uses was displayed by Messrs. Norman Rayne, Ltd., who claim to be the first makers of such small equipment in this country. An armature with a 60-segment commutator, of about 2 in. diam., was shown. This was of American make, but had been rewound by this firm.

Woolwich Housing Estate.—A month ago we referred to trouble which had occurred on the housing estate of the Woolwich Corporation at Eltham, owing to the charge for electricity being 2d. per unit through prepayment meters, and gas not being available. The Borough Council has now decided to substitute the following rates:—£16 per kW on lighting demand, plus ½d. per unit. The hire of a cooker is also reduced from 15s. to 7s. 6d. per quarter. These charges will work out, inclusive of everything, at 2s. per week, payable in advance, plus ½d. per unit, with a discount of 5 per cent. each quarter. The tenants will have the option of prepayment meters or a weekly payment. The tariff seems likely to result in an average of 1d. a unit where people use electric lighting and cooking, diminishing as more extensive use is undertaken. At a meeting of the tenants, the Council's proposals were explained, and a resolution was unanimously passed to the effect that the meeting acknowledged the superiority of electricity over gas, and congratulated the Borough Council on its action.

Institution Notes.

Institution of Electrical Engineers.—OPENING MEETING.—The first meeting of the 1926-27 session was held on October 21st, when Mr. R. A. Chattock, the retiring president, presented the premiums awarded by the Council for papers read last session before the Institution, and also the scholarships awarded by the Institution. Dr. W. H. Eccles, the new president, then took the chair and called upon Mr. Ll. B. Atkinson to propose a vote of thanks to the retiring president; this was seconded by Col. K. Edgcumbe and carried. Mr. Chattock, in reply, referred to his disappointment at the cancellation of the summer meeting during his year of office. The president then delivered his inaugural address, an abstract of which is commenced elsewhere in this issue. After the address a vote of thanks to the president was proposed by Mr. E. H. Shaughnessy and seconded by Prof. Magnus Maclean.

NORTH-WESTERN CENTRE.—The syllabus for the above centre for the first half of the 1926-27 session, together with dates fixed for the second half, has been issued. The opening meeting will be held on November 2nd, at the Midland Hotel, Manchester, when the chairman, Mr. W. J. Medlyn, will deliver his address; this meeting will be followed by an informal smoking concert.

Royal Institution.—LECTURES.—The following courses have been arranged at the Royal Institution during November and December:—The Tyndall lectures will be delivered by Dr. G. W. C. Kaye, who will commence a course of three lectures on "The Acoustics of Public Buildings," on Tuesday, November 2nd, at 5.15; and on Tuesday, November 23rd, Sir William Bragg begins a course of four lectures on "The Imperfect Crystallisation of Common Things." On Saturday afternoons, at three o'clock, commencing on November 27th, Dr. G. C. Simpson will give two lectures on "Atmospheric Electricity." The Juvenile lectures this year will be delivered by Professor A. V. Hill on "Nerves and Muscles: How we Move and Feel."

Institution of Civil Engineers.—On Tuesday last, in the presence of a crowded meeting, the president, Sir William Ellis, G.B.E., presented the Kelvin Medal to Sir Charles A. Parsons, K.C.B., D.Sc., F.R.S.; Sir William said that the consensus of opinion of the world's engineering societies was overwhelmingly in favour of Sir Charles Parsons, to whom the medal had accordingly been awarded by the committee of representatives of eight of the leading engineering societies of this country.

Afterwards Senator G. Marconi, G.C.V.O., D.Sc., delivered the James Forrest lecture, on "Radio Communications."

Institution of Fuel Economy Engineers.—On Friday, November 5th, at 6 p.m., a lecture on "Pulverised Fuel Firing for Steam Boilers," will be delivered by Mr. R. Jackson, at the Royal Society of Arts, John Street, London.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The London Power Company has appointed Mr. S. L. PEARCE, C.B.E., to be its engineer-in-chief in the place of Sir Alexander Kennedy and Mr. G. W. Partridge, who have been the advisers of the company since its inception in 1920. Sir Alexander Kennedy resigned the position on account of ill-health, and Mr. G. W. Partridge resigned on his being elected a member of the board. Mr. Pearce takes up his duties on and from November 1st, when he retires from his position as one of the Electricity Commissioners.

We reproduce herewith a portrait of Mr. G. H. LAKE, who was appointed borough electrical engineer of Derby on October 6th, in the place of Mr. T. P. Wilmshurst, who, as already reported, is to become an Electricity Commissioner. Mr. Lake was educated at the Stoke-on-Trent and Derby Technical Colleges, and served an apprenticeship with a Staffordshire electrical firm, after which he was articled to Mr. Wilmshurst. His first appointment with the Derby Corporation Electricity

Winter] *[Derby.*

Mr. G. H. Lake, A.M.I.E.E.,
Borough Electrical Engineer, Derby.

Department was as junior charge engineer, and he gradually "rose in the ranks" to the position of deputy borough electrical engineer, which he reached in 1917. Since that date Mr. Lake has been engaged in supervising a number of important extensions involving an aggregate expenditure of over half a million. Mr. Lake is a member of the Committee of the East Midland Centre of the I.E.E., and a member of the Derby Society of Engineers.

Dr. ING. E. A. KRAFT, head of the A.E.G. turbine factory in Berlin, has been appointed an honorary professor of the Technical High School at Charlottenburg.

An employé of the English Electric Co., Ltd., Mr. A. JONES, has been presented by his fellow-workers with a wallet of Treasury notes to mark the completion of more than half-a-century's service, which began with Messrs. Siemens Bros. at Woolwich in 1872. In 1903 he was transferred to the packing department at Stafford. Lt.-Col. C. Hardie made the presentation. There are twenty employés whose service began prior to 1890.

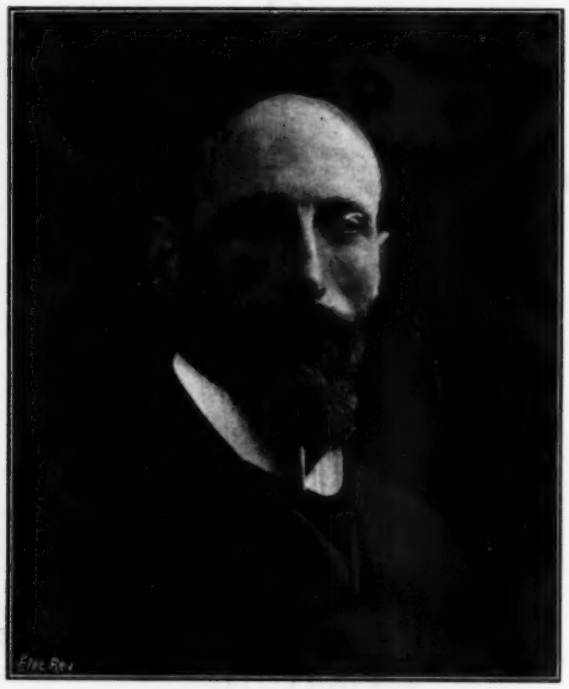
Councillor A. H. GLEDHILL, chairman and managing director of Gledhill-Brook Time Recorders, Ltd., is the prospective mayor of Halifax.

Mr. D. M. PITT, late of the British Electric Transformer Co., Ltd., has been appointed heating and cooking sales representative to the Cable Accessories Co., Ltd., of Tipton, Staffs.

Sydney City Council has appointed Mr. W. RILEY sales superintendent in the Council's Electricity Department.

The Highways Committee of the London County Council recommends that Mr. J. W. J. TOWNLEY, deputy city electrical engineer, Bradford Corporation, be appointed as electrical engineer in the Tramways Department of the Council, rendered vacant by the resignation of Mr. P. L. Riviere, at a salary of £1,200 per annum, plus bonus. There were 53 applications for the position.

Mr. Laurence J. Kettle, whose portrait accompanies this note, is this year's chairman of the Irish Centre of the Institution of Electrical Engineers; he delivered his address in Dublin last week. Mr. Kettle received his early training at Faraday House (he is president of that Institution's Old Students' Association) and later went to Robert Stephenson and Co., Ltd., Newcastle. Subsequently he was with the Société des Forces Electriques de la Goule (St. Imier) and the General Electric Co. His connection with the Dublin electricity undertaking dates from 1912, and he was appointed to his present position of City Electrical Engineer in 1918. Mr.



Mr. L. J. Kettle, M.I.E.E.,
Chairman of the Irish Centre of the I.E.E.

Kettle has made intensive studies of Irish power resources and has written papers and served on committees dealing with Irish peat, coal and water power. Among his other activities, Mr. Kettle is secretary of the Electricity Supply Association of Ireland.

Obituary.—Mr. L. Thornton.—Mr. Leonard Thornton, manager of the electrical department of the Weinbau Incandescent & Electrical Co., died on October 17th, after an operation for appendicitis.

Herr F. Stibral.—The death is reported from Karlsbad, at the age of 66 years, of Herr Franz Stibral, director of the Karlsbad electricity supply undertaking and secretary of the German Association of Electricity Works in Czecho-Slovakia.

Mr. J. Fredholm.—The death is announced from Stockholm of Mr. John Fredholm, a distinguished Swedish engineer, who for 16 years had been with the Swedish General Electric Co. of Vasteras. He was also managing director of the A.-B. Skandinaviska Elektricitetsverket, Stockholm, from 1919.

Mr. G. Salter.—News has been received by cable in Hamilton of the death of Mr. Glynn Salter, a former electrical engineer and superintendent of Hamilton electricity works. Mr. Salter had built up a very successful foundry business in Tasmania.

Mr. C. J. Leyland.—We regret to record the death of Mr. Christopher John Leyland, a director of the Parsons Marine Steam Turbine Co., Ltd., and Parsons Foreign Patents Co., Ltd., which occurred on October 21st at the age of 77 years.

Mr. J. H. Winter.—The death occurred last week of Mr. J. H. Winter, head of Messrs. J. H. Winter & Co., electricians, of Bristol. He was 62 years of age, and had for many years been prominently interested in electrical contracts and developments in Bristol.

Mr. R. St. G. Moore.—We have to record the death at the age of 68 years of Mr. R. St. George Moore, a civil engineer, who was associated with the construction of the foreshore electric tramway between Brighton and Rottingdean, and many other works. He was a past president of the Society of Engineers.

New Companies Registered.

Tricity Restaurants, Ltd. (216,904).—Public company. Registered October 18th. Nominal capital, £40,000 in £1 shares (20,000 7½ per cent. cumulative preference and 20,000 ordinary). Objects: To acquire (1) the business of restaurant proprietors carried on in London by Modern Kitchens, Ltd., and known as the "Tricity Restaurant"; and (2) the benefit of an agreement for the lease dated July 22nd, 1926, between J. H. Hill on the one part and the British Electric Transformer Co., Ltd., on the other part, and to carry on the business of restaurant, hotel and club keepers in London and elsewhere. The minimum cash subscription is 7 shares. The subscribers (each signing for one preference share) are:—E. Newton, 81, Gresham Street, E.C., solicitor; H. A. Norton, 26, Barnsbury Park, Highbury, N., clerk; and five other clerks. The first directors are to be appointed by the subscribers. Qualification, £1. Remuneration, £100 each per annum (chairman, £300). Solicitors: Clifford-Turner, Hopton and Lawrence, 81, Gresham Street, E.C. Registered office: 125-130, Strand, W.C.2.

Mawlite Electric Lamp Co., Ltd. (216,873).—Private company. Registered October 16th. Capital, £200 in £1 shares. Objects: To acquire the business of an agent for automobile, train lighting, sign, miners' and other electric lamps now carried on by J. M. Mawson at 28, Belgrave Road, Westminster, S.W.1. The first directors are:—J. M. Mawson; Mrs. E. Mawson, 28, Belgrave Road, S.W.1; and J. M. Mawson, F.C.I.S., J.P., 32, Strand, and Hilltop, Barrow-in-Furness. Qualification, 5 shares. Registered office: 28, Belgrave Road, S.W.1.

Trevor-Roper, Ltd. (216,930).—Private company. Registered October 14th. Capital, £2,000 in £1 shares (500 5 per cent. participating cumulative preference and 1,500 ordinary). Objects: To acquire the business of an electrical engineer and contractor and dealer in electrical and wireless apparatus heretofore carried on by R. D. Trevor-Roper at Bexhill-on-Sea. The permanent directors are:—C. F. Jackson, "Newland House," Keresley, near Coventry; H. T. Wanklyn, "Pinetrees," Leyland, Lancs. Remuneration as fixed by the company. Secretary: W. A. A. Ward. Registered office: Arden House, Endwell Road, Bexhill-on-Sea.

Stretline Condenser, Ltd. (216,984).—Private company. Registered October 21st. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of wireless apparatus, machinery, tools and implements of all kinds, &c. The permanent directors are:—E. R. Stevenson, 80, Westminster Road, Handsworth, Birmingham; A. J. Line, 391, City Road, Birmingham. Qualification, £1. Remuneration as fixed by the company. Solicitor: E. F. Freeland, 71, Temple Row, Birmingham. Registered office: 77, Fleet Street, Birmingham.

Telephone Berliner (London), Ltd. (216,946).—Private company. Registered October 20th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, accessories and component parts, musical instruments and electrical appliances, &c. The directors are:—H. Defries, 186, Willesden Lane, N.W.6; F. Schwerin, 8, Victoria Louise Platz, Berlin. Qualification, 1 share. Secretary: M. Kroling. Solicitors. Tilley & Watts, 92, Stoke Newington Road, N. Registered office: 34-5, High Holborn, W.C.2.

Dean & Noble, Ltd. (216,935).—Private company. Registered October 20th. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical and mechanical engineers and dealers in electrical, mechanical and wireless goods and fittings carried on by Dean & Noble at 41, Market Street, Hyde, Cheshire, and to adopt an agreement with W. H. Dean and C. E. Noble. The directors are: W. H. Dean, 179, Mottram Road, Hyde, electrical engineer (chairman); C. E. Noble, "Sunnymead," Bredbury, electrical engineer. Qualification, 50 shares Solicitors: Joseph Hibbert & Wilde, 45, Clarendon Place, Hyde. Registered office: 41, Market Street, Hyde.

Scott-Taggart Valve Manufacturing Co., Ltd. (216,910).—Private company. Registered October 21st. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with S.T., Ltd., and to carry on in any part of the world the business of manufacturers of and dealers in, hirers and repairers of all kinds of thermionic valves, apparatus, accessories and the like for radio telephony, radio telegraphy, submarine signalling, wireless broadcasting, telephony, telegraphy and component parts for all or any of the said purposes or other methods of wireless or telegraphic communication, &c. The directors are:—J. Scott-Taggart, "Longsands," Frinton-on-Sea, radio valve manufacturer; Mrs. D. Scott-Taggart, "Longsands," Frinton-on-Sea; F. M. Stenning, 38, Milton Road, East Sheen, S.W.14, clerk; W. J. Lovell, Kenilworth, Tolmers Road, Cuffley, Herts., clerk. The first two named are deemed to have been appointed and to be directors representing the holders for the time being of ordinary shares in the original capital numbered 1-500, and F. M. Stenning and W. J. Lovell are deemed to have been appointed and to be directors representing the holders for the time being of ordinary shares numbered 501-1,000. Remuneration as fixed by the company. Solicitors: Bartlett & Gluckstein, 199, Piccadilly, W.

Deal and Sandwich Electrical Co., Ltd. (216,975.)—Private company. Registered October 21st. Capital, £1,000 in £1 shares (500 preference and 500 ordinary). The objects are: To carry on business as electrical contractors, electricians, generators, engineers, appliance manufacturers, wiremen, vendors and manufacturers of wireless apparatus, motors, dynamos, accumulators, lamps and lighting equipment of all kinds, power distributors, &c. The directors are:—E. A. Pinto, A.M.I.E.E., "Helvellyn," Ellington, Ramsgate, electrical engineer; F. Deverson, High Street, Eastry, Kent, builder; P. G. Richards, West Street, Eastry, Kent, electrician. The preference shares rank first for a non-cumulative preferential dividend at 10 per cent. per annum, and after a dividend of 20 per cent. has been paid on the ordinary shares, they are entitled to a moiety of the balance of undivided profits, provided that the total dividend on the preference shares shall not exceed 20 per cent. per annum. Qualification, £50. Remuneration, not less than 70 per cent. nor more than 80 per cent. of the net profits (as determined by the company in general meeting). Secretary: F. Deverson, High Street, Eastry, Kent.

C. E. Jacob Automobile Electrical Service Co., Ltd. (7,554).—Private company. Registered in Dublin October 20. Capital, £10,000 in 8,000 ordinary and 2,000 7½ per cent. preference shares of £1 each. Objects: To carry on the business of mechanical and electrical engineers, &c. The directors are:—C. E. Jacob, South Hill, Blackrock, Dublin, motor accessory factor; Mrs. T. Jacob, South Hill, Blackrock, Dublin; M. J. Kelly, Victoria Lodge, Seafield Avenue, Monkstown, Co. Dublin, accountant. Secretary (*pro tem.*): J. M. Jacob.

Electrical and Radio Distributors, Ltd. (217,009).—Private company. Registered October 22nd. Capital, £500 in £1 shares. Objects:—To acquire the business of an electrical, automobile, wireless and accumulator service carried on by Basil Tunmer at 71, Monks Park, Wembley. The directors are:—B. T. Tunmer, 71, Monks Park, Wembley, electrical engineer; H. W. J. Rosewarne, 69, Monks Park, Wembley, general printer; C. C. Birrell, 8, Hawthorn Road, N.W.10, radio engineer. Remuneration as fixed by the company. Registered office: 20, Bedford Row, W.C.1.

Chadnetley, Ltd. (216,933).—Private company. Registered October 20th. Capital, £150 in £1 shares. To carry on the business of manufacturing agents of electric lamps and appliances, electrical engineers, &c. The first directors are:—R. Chadwick, 95, Bolingbroke Grove, Wandsworth Common, S.W.11; H. P. Rapinet, 43, Hebden Road, Tooting, S.W.17, manufacturer. Qualification, 1 share. Remuneration, £50 each per annum. Registered office: Vernon House, 40, Shaftesbury Avenue, W.1.

Official Returns of Electrical Companies.

Clear Hooters, Ltd.—I. J. F. Austin, of Upper Priory, Birmingham, was appointed Receiver on October 7th, 1926, under powers contained in first mortgage debentures dated July 10th, 1925.

Aron Electricity Meter, Ltd. (58,650).—Capital, £350,000 in 125,000 preference and 225,000 ordinary shares of £1 each. Return dated June 10th, 1926. 100,392 preference and 75,908 ordinary shares taken up and fully paid up. Mortgages and charges, nil.

Lithanode Co., Ltd. (171,574).—Capital, £3,000 in £1 shares. Return dated August 14th, 1926. 2,202 shares taken up. £502 paid. £1,700 considered as paid. Mortgages and charges, £2,900.

Merthyr Electric Traction and Lighting Co., Ltd. (57,908).—Capital, £100,000 in 6,000 preference and 14,000 ordinary shares of £5 each. Return dated June 16th, 1926. 6,000 preference and 13,000 ordinary shares taken up. £95,000 paid. Mortgages and charges, £48,400.

Oriental Telephone and Electric Co., Ltd. (40,690).—Capital, £900,000 in 600,000 ordinary and 300,000 preference shares of £1 each. Return dated July 13th, 1926. 428,941 ordinary and 188,791 preference shares taken up. £338,660 10s. paid on 149,857 ordinary and 188,791 preference shares (including £12 10s. paid on 50 forfeited ordinary shares). £279,084 considered as paid on 279,084 ordinary shares. Mortgages and charges, £146,169.

Sheffield Electric Power Co., Ltd. (106,880).—Capital, £2,000 in £1 shares. Return dated December 22nd, 1925 (filed June 25th, 1926). Two shares taken up. £2 paid. Mortgages and charges, nil.

Christy Brothers & Co., Ltd. (90,039).—Capital, £40,000 in 32,000 ordinary, 3,000 deferred, and 5,000 preference shares of £1 each. Return dated September 27th, 1926. 30,476 ordinary, 3,000 deferred, and 4,550 preference shares taken up. £28,226 paid. £9,800 considered as paid. Mortgages and charges, £5,000.

General Electric Co., Ltd. (67,307).—Capital, £6,000,000 in 1,800,000 "A" preference, 1,800,000 "B" preference, and 2,400,000 ordinary shares of £1 each. Return dated July 26th, 1926. 1,800,000 "A" preference, 1,800,000 "B" preference, and 2,141,975 ordinary shares taken up. £4,720,140 paid on 1,575,540 "A" preference, 1,777,109 "B" preference, and 1,367,500 ordinary shares. £1,021,826 considered as paid on 224,400 "A" preference, 22,891 "B" preference, and 774,475 ordinary shares. Mortgages and charges, £3,344,600.

Vaughan Crane Co., Ltd. (61,526).—Capital, £150,000 in 50,000 preference and 100,000 ordinary shares of £1 each. Return dated August 23rd, 1926. 16,880 preference and 53,578 ordinary shares taken up. £43,689 paid. £26,789 considered as paid. Mortgages and charges, nil.

Electricity Finance and Distribution Corporation, Ltd.—Particulars filed on £5,000 debentures authorised by resolutions of September 23rd and October 12th, 1926, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Le Bas Tube Co., Ltd.—Satisfaction to the extent of £10,000 on July 15th, 1926, of debentures dated May 11th, 1925, securing £50,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Anglo-Portuguese Telephone Co., Ltd.

At an extraordinary meeting on October 22nd, resolutions were submitted increasing the capital of the company to £800,000 by the creation of 300,000 new shares of £1 each, and altering the articles of association to permit of an increase in the number of directors. Lord St. Davids (chairman), who presided, said that if the first resolution was passed the company would have an unissued capital of £400,000, which would be available for conversion. The operations of the company were now on a gold basis, thus avoiding the loss on exchange which had badly affected the company in the past. During the last few years the capital expenditure had been heavy. They had borrowed money from trust companies and had expended the 1925 profit, but still more capital was needed. The current year's profit was estimated at 8 per cent. on the share capital. They proposed to create £400,000 of 7 per cent. debenture stock and to issue £300,000 of it immediately at par. The stock would hold rights to convert it into shares at par until December 31st, 1929; after that date it would be repayable at 102 per cent. The issue would enable them to repay indebtedness and leave £85,000 for capital expenditure and £100,000 of stock for future issue. Moreover, it would free their revenue for dividend purposes; if the scheme went through they hoped to pay an interim dividend next month and a substantial final dividend later. The resolutions were adopted unanimously.

Lisbon Electric Tramways, Ltd.

The report for the year ended December 31st, 1925, records a net profit of £166,624. To this is added £9,631 brought forward, making £176,256. From this the amount of £50,000 has been transferred to reserve, leaving an available balance of £126,255, out of which the preference dividend for the year was set aside, together with the further sum of £76,600 on account of preference dividend arrears. £5,000 has been transferred to the staff benefit fund and £10,000 to exchange reserve. This leaves a balance of £9,122 to be carried forward. During the year the number of passengers carried rose from 83,782,431 to 89,687,203. Two years' dividend upon the preference shares is still in arrears, *viz.*, for the years 1923 and 1924. The meeting is to be held on November 3rd.

Drake & Gorham, Ltd.—The accounts for the year ended June 30th last show a net profit of £8 920, as compared with £2,903 in 1924-25. The sum of £186 is brought forward, making £9,106. It is proposed to distribute this as follows:—Dividend at the rate of 5 per cent., £6,250; to general reserve, £1 000; carried forward, £1,856. The report, referring to the satisfactory results, says that overhead charges have been reduced, and the company is in a position to take advantage of the ever-widening scope for electricity in all branches. Contracts for radio installations have been carried out in 79 hospitals and for numerous private users. The meeting was to be held yesterday (Thursday).

Marconi International Marine Communication Co., Ltd.—An interim dividend of 3¾ per cent. has been declared.

In announcing the dividend, the directors state that the company and its principal competitor, the Radio Communication Co., Ltd., have recently come to a working arrangement which should enable each company to effect substantial reductions in expenditure and to improve the general service given to shipowners. "This arrangement in no way interferes with the separate entity of the two companies. Each company will continue to develop and supply its respective types of marine equipment and to maintain a healthy spirit of competition."

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

United River Plate Telephone Co., Ltd.—1,62,000 new ordinary shares of £5 each fully paid, Nos 912,001 to 1,064,000.

Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone and Telegraph Co.—$129,077,700 capital stock.

Metropolitan Railway Co.—£750,000 three and a-half per cent. "A" debenture stock.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the register at the expiration of three months unless cause is shown to the contrary:—

Borra Magneto Repairing Co., Ltd.
Multi Electrode Radio Valve Co., Ltd.
Savoy Electric Construction Co., Ltd.
Woodhouse and Baillie Riviera Electricity Co., Ltd.

Westminster Electric Supply Corporation, Ltd.—At the meeting held on October 20th, to approve the conversion of £250 000 of unissued preference capital into ordinary shares, making the ordinary capital £1,450,000, it was announced that the board intended to distribute a bonus of two new ordinary shares for each three held, under the provisions of the London Electricity (No. 2) Act.

South American Light and Power Co., Ltd.—The net profit for 1925-26 is £35,754, and the addition of £4,716 brought forward makes an available balance of £40,470. It is proposed to transfer £25,000 to reserve and to pay a dividend of 7 per cent., leaving £5,390 to be carried forward. It has been decided to write off the concession and goodwill account (£52,000) against the reserve, which stood at the same figure.

Metropolitan Electric Supply Co., Ltd.—On October 21st a meeting of the 3½ per cent. mortgage debenture holders was held in London to consider the exchange of their holdings for 3½ per cent. Conversion Loan, at the rate of £105 for each £100 of stock held. The necessary resolution was moved by the chairman of the company, Mr. A. W. Tait, C.B.E., and was carried after some opposition.

S. Smith & Sons (Motor Accessories), Ltd.—A meeting of holders of the 8½ per-cent. first mortgage debentures is to be held to-day (Friday) for the purpose of considering a proposal by the directors that the beginning of drawings and contributions to a sinking fund be further postponed until October, 1939, and January, 1938, respectively.

Herbert Morris, Ltd. — The trading profit for the past year was £67,347; to this were added interest and a balance of £33,141 brought forward, making £109,589. A final dividend is to be paid on the ordinary shares, making 10 per cent., free of tax, for the year; £10,000 is put to reserve; and £38,884 is carried forward.

Manaos Tramways and Light Co., Ltd.—The net balance for the year ended April 30th last is £18,904. Of this £10,313 has been transferred to renewals reserve and 3½ per cent. is being paid on the 7 per cent. participating first debentures. The last interest payment was made at the beginning of 1921.

Chelsea Electricity Supply Co., Ltd.—The directors announced last week that it was proposed to capitalise £150,000 of the reserves, under the London Electricity (No. 2) Act, and distribute it in the ratio of three new £1 shares for each 5 at present held.

Argentina Light and Power Co., Ltd. — At the general meeting to be held to-day (Friday) it will be proposed that the company's name be altered to "The Atlas Light and Power Co., Ltd."

Joseph Lucas, Ltd.—The directors recommend a final dividend of 10 per cent. on the ordinary shares (making 15 per cent. for the year) out of net profit and balance forward amounting to £277,688.

Electrical Distribution of Yorkshire, Ltd.—An extraordinary meeting is to be held at Leeds on November 2nd to consider resolutions for increasing the capital to £1,000,000 by the creation of 500,000 new shares of £1 each.

United River Plate Telephone Co., Ltd.—An interim dividend of 3 per cent., free of tax, has been declared on the ordinary shares.

Isle of Wight Electric Light and Power Co., Ltd.—An interim dividend of 4 per cent., free of tax, has been declared on the ordinary shares.

Erinoid, Ltd.—The directors propose to pay a final dividend of 6 per cent., making 10 per cent., as compared with 12½ per cent. for the preceding year.

Stothert & Pitt, Ltd.—A dividend of 2½ per cent. has been declared on the ordinary shares, there having been a considerable improvement in the results for the past year.

Brampton Bros., Ltd.—The directors recommend a dividend of 10 per cent. on the ordinary shares for the past year.

Stocks and Shares.

Monday Evening.

The market in London electricity shares has received two unpleasant shocks in the shape of the proposals put forward by the Westminster Electric Supply and the Chelsea Electricity Companies. After the extremely satisfactory schemes propounded by the Kensington and the St. James' and Pall Companies, the Westminster share bonus of £2 for every three shares held and the Chelsea's £3 for every five shares came as sharp disappointments. Something much better had been expected in both these cases. The price of Westminsters had been about 49s. before the company's circular appeared, and it gave way to 41s. 3d. Chelseas suffered less considerably, falling from 43s. to 39s., and recovering to 40s. Kensingtons and St. James' maintain their previous big gains, and London Electrics are harder at 37s., but various others have gone back, Counties and City Lights amongst them. The County Company's statement is likely to be made next week, and is awaited with eager curiosity.

In the provincial group, active dealings followed the allotment-issues of the new Midland Counties. The preference changed hands up to about 6d. premium, to react to "par" as the stag-selling made its effect felt, and then to recover the previous premium. The new ordinary opened around 6d. discount, but were soon at a modest premium. No change occurred in the existing old ordinary at 20s. 6d. Bournemouth and Poole came down from 61s. to 57s. 6d. in sympathy with the weakness that developed in the London list. Rumour persists, however, that Bournemouth and Poole shares are to be "taken-over" on terms substantially higher than the current market quotation represents. The talk is likely to prove ill-founded, but other favourable factors are present.

Marconis leapt into the limelight with a rise from 13s. 9d. to 18s. 6d. upon the statement that the "Beam" system between Bodmin and Canada bids to prove a great success, and that the "lines" would open for traffic yesterday, Sunday. Something of this kind had been expected for some time past, but it did not stop bear sales of Marconi shares, and the short-brigade has been very active of late. Bears hastened to get level when the "Beam" news arrived, and this stimulated the rise in the shares. After touching 18s. 6d., the price subsided to 17s. 6d. Canadian Marconis went up from 3s. 1½d. to 4s. 6d., and stayed at the latter price. The Marconi Marine Company has declared an interim dividend of 3¾ per cent., actual, less tax, and announces that a working arrangement has been reached with the Radio Communication Company. The two companies will retain their separate entities, but reduction in expenditure and improvement in public service are expected to follow from the rapprochement. The Radio Communication Company must not be confused, of course, with the Radio Corporation.

The violent recovery in Marconis, and the reason for it, tended to arouse a feeling of nervousness in regard to the stocks and shares in the cable companies. Eastern ordinary stock has shed 9½ points; Eastern Extensions and Westerns have given way. There was no particular volume of selling to cause these declines. Prices went down more by way of precaution than by pressure of sales, but, as experience has shown, this market is peculiarly sensitive to wireless shocks. The other cable issues are tolerably steady. A lively business sprang up in Telephone Manufacturing shares, when the price advanced from 7s. 6d. to 8s. 9d. on reports that the company is doing a flourishing business. The outstanding debentures will be repaid at the end of this year, thus leaving no fixed charges in front of the ordinary shares.

United River Plate Telephones at 7¾ are ex rights, the value of which is about 54s.—a handsome bonus. Chili Telephone new ordinary stand at 6¼. Anglo-Portuguese Telephones strengthened to 17s. 6d., and are now 17s.

Home Railway stocks are disposed to be dull, with Metropolitans down to 60. The time is approaching when the dividends for the final half of 1926 will be announced, and, having regard to the protracted nature of the coal dispute these distributions are not expected to be on any generous scale. Hence the present disinclination on the part of the public to look at Home Railway stocks as investments. Brazilian Tractions enjoyed a sharp recovery to 112¼, and the preferred rose to 105½. British Columbia deferred at 142 is a point down, after touching 140. The Mexican group is quiet, and Sidro shares remain at about 12.

Manufacturing shares are inclined to be a little heavy. Brush are a good market, with a rise of 1s. to 27s., but small declines have taken place in Siemens, Henleys and General Electrics. The iron and steel group is better, owing to the placing of several good contracts during the past few business days. The rubber market is somewhat reactionary, by reason of a fresh notification from the Colonial Office, which, while regarded as satisfactory so far as it goes, is not as stimulating as the optimists had hoped that it might turn out to be.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Oct. 25 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	59/6	—1/9	4 14 2
Brompton Ordinary	1	10	10	1⅝	—	5 12 2
Charing Cross Ordinary	1	15	15	2⅞	—⅛	6 6 4
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—⅛	6 0 0
City of London	1	15	15	50/9	—	5 18 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	+1/-	5 14 4
County of London	1	15	15	3⅛	—⅛	4 16 0
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—9d.	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	17	—	4 8 3
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	36/-	+6d	5 11 1
do. do. 6% Pref.	5	6	6	52	—	5 11 7
Metropolitan	1	11	11	40 9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	20/6	—	5 17 1
Newcastle-on-Tyne Ordinary ...	1	7	7	21/3	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	1+½	—	4 14 7
South London	1	15	15	2½	—	5 6 8
South Metropolitan Pref.	1	7	7	1⅛	—	5 12 0
Urban Ordinary	1	4	7	1⅛	—	5 12 0
do. 6% Pref.	1	6	6	21/-	—	5 14 3
Westminster Ordinary	1	15	15	2⅛	—⅛	7 5 5
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	80	—	5 15 11
Metropolitan	,,	5	5	80	—1	8 6 8
do. District	,,	3½	3½	54	—	6 9 3
Underground Electric Ordinary ...	10	Nil	Nil	4	—	Nil
do. do. "A" ...	1/-	Nil	Nil	12/-	—	Nil
do. do. Income ...	Bonds	6	6	101	—	*5 18 10

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—⅛	5 17 1
do. Def.	,,	1½	1½	24½	—	6 1 3
Automatic Telephone	1	3	10	2⅞	+1/8	3 9 7
Chili Telephone	5	5	6	6¼	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅛	—	7 0 4
Eastern Extension	10	10	10	18xd	—1	*5 11 1
Eastern Tel. Ord.	Stock	10	10	180	—9½	*5 11 1
Globe Tel. and T. Ord.	10	10	10	19½	+⅛	*5 8 11
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—½	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	17 6	+⅞	... ...
Marconi-Marine	1	10	7½	1⅛	+1/8	6 13 4
Oriental Telephone Ord.	1	12	12	46/8	—	*5 8 10
United R. Plate Tel.	5	8	8	7⅞xr	—	*5 1 7
Western Telegraph	10	10	10	17½	—1	*5 14 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3	—	9 3 4
do. do. 2nd Pref. ...	5	6	6	2½	—	10 13 4
do. do. 5% Deb. ...	Stock	5	5	75	—	6 11 4
British Electric Traction Ord. ...	,,	7	8	140	—	5 14 4
do. do. 6% Pref. ...	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	112½	+7½	4 0 0
Brit. Columbia Elec. Ry. Pcc. ...	Stock	5	5	80½	—	5 15 7
do. do. Preferred ...	,,	90/-	126/9	114½	+1	*5 11 6
do. do. Deferred ...	,,	129/5	8	148	—	*5 12 0
do. do. Deb. ...	,,	4½	4½	77½	—	5 7 7
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	48½	—	9 6 0
Mexico Trams, 5% Bonds	—	5	5	67½	—	7 8 2
Mexican Light Common	100	Nil	Nil	86½	—	Nil
do. Pref.	100	Nil	Nil	85½	—	Nil
do. 1st Bonds	—	5	5	70	—	7 2 10
Yorkshire (West Riding)	1	5	—	11/8	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	13	59/-	—9d.	4 18 1
British Aluminium Ord.	1	5	10	46/3	—	4 6 8
British Elec. Tr nsformer Pref. ...	1	Nil	7	18/3	—	7 13 8
British Insulated Ord.	1	15	15	3½	—	4 5 9
Brush Ord.	1	10	10	27/-	+1/-	7 8 2
Callenders	1	15	15	3⅓	—	4 10 9
do. 6½% Pref.	1	6½	6½	24/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	66	—	5 16 3
Electric Construction	1	10	10	22/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1⅞	—	6 6 4
English Electric	1	5	Nil	14/6	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	2 /-	—	5 13 1
do. Ord.	1	6	7½	30/-	-9d.	5 0 0
Henley	1	15	20	4	—⅛	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	68/9	—	5 9 9
Met.-Vickers Ord.	1	8	8	26/9	—	6 4 9
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	1 ⅛	—⅛	5 4 4
Telegraph Construction	12	20	10	90⅜	—	*3 18 9

*Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in September, 1926.

We have to go back to December, 1923, to find a higher monthly export total than the one recorded below for last month, and, in spite of the explanation which follows, the figure can be regarded as very satisfactory, especially when the state of British industry generally is taken into account.

The explanation of the large increase over the totals for August last and September, 1925, is the tremendous rise in the value of exported submarine cable. The large total of £3,043,252 in December, 1923, referred to above, was due to a similar cause, submarine cable accounting for £1,914,214. With this item allowed for, however, the exports were still maintained above the average level for the year. The other variations from the August figures were fairly evenly balanced; considerable decreases in unenumerated electrical machinery, telegraph and telephone apparatus, and meters and instruments were compensated for by increases in insulated wires and cables, "other" motors and generators, unenumerated electrical goods and apparatus, and switchboards. Comparing the figures with those for September, 1925, it will be seen that there was a general increase, the only decline being the comparatively unimportant one in arc lamps and parts. Thanks to the aid of the submarine cable figure, the decrease for the completed part of the year as compared with the corresponding period of 1925 has been reduced to £214,298.

There was an 11 per cent. increase in the imports as compared with August, but they were more than £27,000 below those of a year ago. Among the items the increases predominated, those in batteries and accumulators and carbons being the largest. The decreases were not of great moment.

The re-export section exhibits nothing unusual, several large increases being almost balanced by the increases. Re-exports were about 25 per cent. above those for September, 1925.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Sept., 1926.	Inc. or dec. as compared with Aug., 1926.	Inc. or dec. as compared with Sept., 1925.	Electrical imports for Sept., 1926.	Inc. or dec. as compared with Aug., 1926.	Inc. or dec. as compared with Sept., 1925.	Electrical re-exports for Sept., 1926.	Inc. or dec. as compared with Aug., 1926.	Inc. or dec. as compared with Sept., 1925.
Electrical goods and apparatus									
(unenumerated)	£165,429	+ £17,770	+ £16,411	£95,722	+ £9,528	+ £9,283	£4,944	+ £71	−£1,018
Insulated wires and cables ...	311,379	+ 43,206	+ 111,088	46,353	+ 1,689	− 4,867	563	− 912	− 404
Glow lamps	35,486	− 4,447	+ 1,227	30,370	− 185	+ 1,568	472	− 611	+ 199
Arc lamps and parts	545	− 182	− 607	9,128	+ 8,778	+ 7,122	12	— 206	− 78
Batteries and accumulators ...	79,241	+ 4,959	+ 4,845	78,638	+ 20,966	+ 9,001	1,284	+ 1,074	+ 925
Meters and instruments ...	31,229	− 11,138	+ 7,768	12,422	− 4,635	− 9,812	602	+ 429	+ 11
Carbons...	1,479	+ 530	+ 384	3,623	+ 11,951	− 4,037	31	− 359	− 161
Electrical Machinery—									
Electrical machinery (unenumerated)	202,605	− 56,554	+ 27,359	70,633	− 6,209	− 26,569	6,357	− 3,121	+ 1,984
Railway and tramway motors	23,721	− 8,971	+ 181	—	—	—	—	—	—
Other motors and generators...	220,270	+ 48,709	+ 41,887	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	15,052	+ 12,510	+ 9,733	86	− 353	+ 59	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	72,720	+ 9,119	+ 20,033	16,475	+ 10,382	− 1,759	1,778	+ 1,774	+ 1,204
Submarine telegraph and telephone cable...	668,510	+ 663,106	+ 213,597	1,506	+ 1,505	+ 1,506	—	—	—
Telegraph and telephone instruments and apparatus ...	257,528	− 39,047	+ 54,115	40,617	+ 10,877	− 8,735	4,661	+ 2,275	+ 2,245
Totals	£2,084,194	+£679,870	+£547,951	£405,973	+£40,403	−£27,320	£20,704	+ £409	+ £4,908
		Exports.			Imports.			Re-exports.	
Decreases for nine months of 1926 ...		£214,298			£431,219			£31,543	

The Recovery of Japan.

The Aftermath of the Earthquake.

There has been published recently a report upon the commercial, economic, and financial conditions in Japan during the two years ended June 30th last, by the British Commercial Secretary at Tokio, Mr. R. Boulter, C.M.G.*

The period dealt with has been one of reconstruction, readjustment and retrenchment, after the disastrous earthquake of 1923, and is consequently abnormal. An outstanding feature of the period is the tremendous increase in imports due, principally, to the suspension of import duties upon materials urgently needed in the rehabilitation of the stricken areas. The subsequent reaction will be strengthened by the determination of the Japanese at the call of the Government to restrict importation to necessities. The influx of non-essentials is to be checked by special duties, and the export of Japanese products is to be sedulously fostered. Side by side with this, public expenditure is to be drastically curtailed.

In the financial field, the report states that no public loans were floated in the open market during the period, but Japanese companies had recourse to foreign markets for loans to a considerable total. Among the loans specified are the following:—The Daido Consolidated Electric Power Co., $15,000,000 and $13,500,000; the Ujigawa Electric Power Co., $14,000,000; the Toho Electric Power Co., $15,000,000 and £300,000; and the Tokyo Electric Light Co., $24,000,000. Public utility enterprises, such as railways, tramways, and electricity supply companies, have figured largely among the firms issuing debentures. This form of capital is preferred to share issues on account of the lower interest rates. The demand for this type of security has declined however.

Business circles in Japan received a shock in 1925, when the great firm of Takata & Co. failed with a deficiency of 30 million yen.† The failure did not, however, affect other large houses, as was dreaded. The firm was a large machinery importer and, among many other things, was connected with an electric railway.

Electrical and Radio Imports.

The imports of machinery as a whole rose from 102,341,000 yen in 1923 to 128,523,000 yen in 1924, but then declined considerably to 88,996,000 yen in 1925, and they were 32,391,000 yen in January-April, 1926. Speaking generally, the increase in 1924 was due to the replacement of earthquake losses, while in 1925 industrial depression affected business. Although the development of Japan's manufacturing industries will call for the supply of new plant of various kinds, the domestic production is steadily increasing in volume and advancing in skill. The new duties are higher and being on a specific basis act to the detriment of the more solid type of machinery produced in the United Kingdom. An examination of some of the principal items of machinery shows a striking reduction in dynamos, motors, transformers, converters, and armatures, *viz.*, from 21 million yen in 1924 to 12 millions in 1925. In the future some increase in demand may be expected from the

*Stationery Office, 2s. 6d. net.

†Yen = about 2s.

electric power companies, which are supplementing their water-power resources with steam stations. A number of orders are in course of execution, and although there are indications of an approaching surplus production of power, consumption continues to increase in spite of industrial depression. The progress of railway electrification is another source of orders, and textile-factory extensions are anticipated as a result of the prohibition of night work for women and juveniles.

The establishment of broadcasting stations in Tokio, Osaka, and Nagoya during 1925 met with immediate popular support and radio quickly became the vogue; at the end of April, 1926, 300,000 licences had been issued. It is reported that the three stations mentioned will shortly be amalgamated into one large corporation, which will operate seven main stations and four relay stations. Receiving sets are subjected to an examination at the Electrical Laboratory, and subject to special sanction the wave-length range is restricted to 400 metres. The market for radio apparatus was soon heavily overstocked, and importers became extremely cautious in placing new orders, while prices slumped. A recent report states that the market is still congested; dealers expect at least a 20 per cent. margin, but very few are able to work on this basis. There are no fixed prices, since dealers dispose of their stock as best they can. Low-priced sets and accessories, including loud speakers, still find a market, but expensive outfits move very slowly indeed. There is an opening for loud speakers which could be retailed at not more than 20 yen (about £2); at present one or two are offered, but they are not satisfactory. Equally a market exists for receiving sets giving reasonable results at a moderate figure; the average Japanese cannot afford to pay much for a luxury such as a receiving set. The simpler types of receivers, as also cabinets for more expensive sets, are made in Japan. In imported goods, American, and in a lower degree German, apparatus offers the principal competition to be faced by British manufacturers.

The report gives no details of Japanese electrical exports, but an appendix shows that the total value of insulated electric wire exported during 1925 was 1,773,000 yen, as compared with 1,371,000 yen in 1924; the exports during the first five months of the current year were valued at 801,000 yen. The exports of machinery and parts were as follows:—1924, 10,383,000 yen; 1925, 9,929,000 yen; 1926 (five months), 3,962,000 yen.

Electric Railways and Tramways.

The report gives statistics of Japanese railways as they existed on March 31st last. It is shown that out of a total of 3,027 miles of railways, 2,104 miles were wholly electrically operated, and a further 316 miles worked jointly by steam and electricity. There were 1,575 miles of tramways, of which 1,056 miles were electric.

A commencement has been made with the construction of an underground railway in Tokio by the Tokio Chikatetsudo (Underground Railway) Company. The section upon which work is now proceeding is about a mile long, and forms part of a line which will eventually have a length of about 14 miles. Both the Tokio and Osaka municipalities have projects under consideration for the building of a network of underground lines, but work has not yet been commenced.

Radio-Telegraphy.

Reference has already been made to the institution of broadcasting in Japan. In connection with another branch of the radio art, long-distance telegraphy, a company was formed in November, 1925, with the title the Japanese Wireless Telegraph Co., Ltd., and a capital of 20 million yen. One quarter of the capital is paid up, and the object of the company is to supply and erect for Government use equipment for handling radio telegrams. It is under Government control and has taken over the whole business of radio-telegraphic communication with foreign countries. In return for a proportion of its shares the Government station at Iwaki has been transferred to the company, which will in course of time erect stations for communication with Europe (one), America (two), China, Australia, India and Siberia (one), and a central receiving station.

A law passed in November last requires all vessels of 2,000 tons gross or over, and those carrying more than 50 persons, to be equipped with a radio-telegraphy installation. The law applies to foreign shipping entering or clearing ports within the area over which the law is enforced.

Exports and Tariffs.

As we have already pointed out, steps have been taken to encourage the export of Japanese goods. One means adopted is the establishment, by law, of export guilds, and guilds of manufacturers of staple export commodities. These are co-operative bodies formed for the purpose of not only handling exports but also of investigating foreign markets. The manufacturers' guilds also carry out investigations and co-operative research.

The tariff position has altered in four directions during the past two years; these are the institution of a "luxury" tariff, the lapse of the Anglo-Japanese Conventional Tariff, a preferential tariff upon certain products of the Kwantung Leased Territory imported into Japan, and the general revision of the Japanese Statutory Tariff.

Korean Developments.

In a separate, appended, report upon Korea by Mr. A. H. Lay, C.M.G., British Consul at Seoul, it is stated that the Government schemes for the improvement of the territory include the erection of a large hydro-electric plant in South Kankyo Province. Broadcasting is becoming popular, and many shops in Seoul now deal in radio apparatus, the cheaper kinds being preferred. A large quantity of batteries is imported from Japan.

Domestic Electricity Supply.

Report of the Advisory Committee on Domestic Supplies and Methods of Charge.

The Report of the Advisory Committee on Domestic Supplies of Electricity and Methods of Charge, which was appointed by the Electricity Commissioners under the provisions of Section 4 of the Electricity (Supply) Act, 1919, is now available (H.M. Stationery Office, price 1s. net); the following is an abstract of its contents.

The Committee is greatly impressed with the potential value of electricity in the home for lighting, heating, cooking, ventilating, and for certain household tasks usually performed by manual labour, and although for some time to come the extent to which it can supplant other means of lighting, heating, cooking and labour saving in the home must vary considerably in accordance with the electrical facilities offered in different areas, there is certainly room at the present time for great extension, to the benefit of the user, the community, and the electrical industry. In connection with any re-organisation of electricity supply, the encouragement of the use of electricity for all purposes in the home, in shops, and in offices, appears to be of prime importance.

In the average middle- and working-class electrically-equipped houses in the more advanced areas to-day, the consumption per house ranges from 100 to 300 kWh per annum for lighting, but reaches 1,000 to 3,000 kWh when electricity is also used for cooking, partial and occasional heating and certain labour-saving devices. Every endeavour should be made to overcome the initial difficulties connected with the provision of wiring installations adequate for all the domestic uses of electricity in both old and new houses. Everything possible should be done to provide a supply of electricity in all areas where there is a demand and a reasonable prospect of the demand becoming remunerative; and, whether an immediate supply is available or not, builders and owners of property should be encouraged and recommended to wire fully all new houses in anticipation of a supply of electricity for all purposes becoming available at economic prices at an early date.

The Committee feels that it is almost impossible to over-emphasise the importance of the distribution or retail side of the supply undertaking. There exists a growing demand by the public for electricity for all purposes, and a belief in its universal applicability, and it is important, therefore, that those in actual control of its distribution should be afforded full scope for the exercise of initiative and enterprise. In some cases the technical development of supply undertakings is in advance of their business organisations. There is need for more commercial uniformity; rates and charges, service and selling methods should be dictated by the character and needs of districts, and should, as far as practicable, become uniform over large areas. In connection with commercial reorganisation the Committee directs attention to the need for constant co-operative study of supply economics and commercial conditions by the supply-undertaking assistants whose work brings them into direct touch with the public.

The high prices obtaining for electrical wiring and apparatus and in some areas for the supply of electricity are the chief deterrents to a wider use of electrical power in the home. While it is easy to persuade the domestic consumer to adopt electricity for lighting even in areas where the price is comparatively high, it is useless for the distributor to expatiate on the merits of its other uses unless the charge for the supply and the cost of the necessary apparatus are within the purchasing power of the householder.

A.c. supplies provide a more flexible and easily extended network of distribution mains, and existing d.c. distribution may need to be supplemented by a.c. systems, and extended in that form, as the demand in those particular areas for electricity for heating and cooking in the household increases. The evidence before the Committee confirms the anticipated high "diversity factor" of a general domestic load. Where cooking and some short-period heating supplement the use of electricity for lighting, diversity values of the order of 6 to 8 have been noted, and the anticipated rapid development of electrification will tend to accentuate this valuable feature. On small distribution systems reconstructions may be necessary to deal with any extensive domestic use of electricity. Provided, however, a company's commercial future is safeguarded, there is ample evidence of the economic soundness of investment in distribution works established primarily for the purpose of affording full domestic supplies.

Under their existing powers to use overhead lines, authorised undertakers are hampered by the necessity of obtaining the consent of the Minister of Transport in every case, and it is recommended that it be made possible for undertakers to apply for, and for the Minister of Transport to grant, a general power to use overhead lines, on compliance with certain basic specifications, throughout defined but large areas without the necessity of securing particular consents in relation to specified routes and positions. Delay in securing wayleaves on private property could be reduced by official recognition of standard rates for such wayleaves. For general use, one shilling per annum per single pole in the case of overhead lines, and one shilling per annum per 100 yards in the case of underground mains is now generally accepted as being equitable. The existing arrangements for obtaining consent to erect overhead lines and for securing the necessary wayleaves should be simplified and improved; and applications for such consents and wayleaves should be proceeded with concurrently.

All undertakers should be given special powers by general legislation to break up streets, thus relieving them from the existing obligation to comply with the procedure prescribed in the Electric Lighting Act, 1882. At present the Postmaster-General calls upon authorised undertakers, at their own expense, to provide protection for the Post Office lines, even when the authorised undertaker is "first comer." The Committee considers that there should be equality of treatment, and that the "second comer" should pay for the alterations to or protection for the works of the "first comer." It is suggested that the Electricity Commissioners should invite representatives of the Postmaster-General and the supply authorities to confer together with the view of securing some relaxation in the requirements of the Postmaster-General.

Statutory powers are needed to permit the lopping of trees growing on private land and overhanging public roads in a manner obstructive to the erection and maintenance of overhead power lines. Where the local authority is not the undertaker, the authority by whom the street is repairable has at present a veto in respect of above-ground street boxes, which is sometimes arbitrarily exercised. In view of the importance of power supplies, this veto should be removed. It has been strongly represented that for overhead lines for low- and medium-pressure distribution, a modification easing the existing regulations is urgently required; something in the nature of a set of tables, giving information and dimensions which would permit undertakings, contractors, or even intelligent workmen, by using local material and certain standard insulators, fittings and sizes of conductor, to erect lines which would comply with the requirements and call for no more special inspection than does a wiring installation in a building, seems to be desirable.

Authorities making or carrying out alterations to roads and bridges should be liable for the cost to statutory undertakers of altering the position of mains and services necessitated thereby. It would appear reasonable that in making arterial roads, provision should be made for cable crossings immediately required or likely to be required in the near future.

It is also desirable that undertakers should be authorised to attach brackets to buildings for the carrying of overhead lines, lamps, and apparatus.

The Committee suggests that the Commissioners should provide simpler and cheaper procedure for obtaining Special Orders, particularly those authorising extensions of existing areas of supply, and with the view of facilitating electrical development in areas where procedure by Special Order would not be expedient, there should be legislation providing for the granting of the necessary powers by licence. The present procedure for obtaining Departmental Orders of the Commissioners ("Fringe" Orders) should be extended to enable the Commissioners to grant such Orders, not only in respect of specific premises as at present, but also in respect of contemplated housing estates.

It is essential that the *form of tariff* for bulk supplies should be such as to make it possible for the distributor to obtain the diversified load upon which the financial success of a bulk supply depends.

The Committee considers that none of the multipart tariffs at present in use or suggested are sufficiently perfect for recommendation for exclusive adoption at the option of authorised undertakers; but that such tariffs (by agreement with the consumer) of the simplest possible character should be strongly recommended for domestic supplies, and that they are of little use and will not achieve their object unless the alternative method is a relatively high maximum or actual flat rate; also that a domestic multipart tariff should need only one integrating meter and preferably no other instrument; and that it should not involve the frequent inspection of premises.

A fixed charge per sq. foot of regularly-lighted floor-area, or per "active" room, plus a unit charge for all purposes, through one meter, is considered a suitable tariff for domestic use. For small property where prepayment meters are desired, the fixed charge could in many cases be collected from the landlord, who would include it in the rent, perhaps charging a small commission thereon. At the present time special slot-meters are being developed to take a "fixed charge" payment at regular intervals, and then to release "units" by the insertion of further coins as needed. The simpler forms of multipart tariffs can be adapted to any domestic premises, and their general use is, in the opinion of the Committee, a first essential to the wide use of electricity in the home. It is also recommended that all undertakers should have statutory authority to make tariffs and charges which, in certain cases, can include, not only a charge in respect of the electricity supply as metered or contracted for, but also a charge for the hire or hire-purchase of the wiring installation, fittings, apparatus, the whole or part of the service cable, or any other material, work and service provided by the electricity supplier to the consumer for his use and for which the undertaker is entitled to make a charge.

Most undertakings already have the right to impose minimum charges. This has caused trouble with very small consumers, who object to paying for what they say they have not used. It is very essential, however, that the right to make a minimum charge should be retained, and in connection with multipart tariffs it should be made quite clear that the fixed charge is in the nature of a minimum. It is submitted that the time has arrived for greater uniformity of action in regard to meter rents, service charges, charges for main-fuse replacements, and small items of a similar kind, which are common to most supply undertakings.

Where multipart tariffs are employed there is much to be said for including the meter rental in the fixed charge, but in all cases these ancillary costs should be kept low. It is better from a business point of view, and more economical from the point of view of staffing and organisation, to remove any source of irritation to the consumer by reducing the charges for ancillary services to a minimum and leaving the rates for the electricity supply to cover such expenses.

It is evident that practically all the local authority undertakers consider that the possession of full trading powers is vital to development, and already co-operation between electricity undertakers and the retailers is well organised and successful. In this matter, the interest of the British manufacturers should not be overlooked; the inventor, designer and producer are entirely dependent for success and encouragement upon finding someone willing and able to place new devices before the public and to assist in securing their adoption. The Committee therefore submits that full trading powers should be granted to those local-authority undertakers who do not at present possess them. Contractors admit that as a body they are seldom in a position to let out apparatus on hire-purchase terms. As the tendency at the present time is for the public to purchase apparatus and accessories in this way, every undertaker should be encouraged to make available to all consumers a hire system and/or a hire-purchase system for the wiring installation and for domestic fittings, appliances and apparatus of standard type, coupled with an efficient maintenance service. It is desirable and quite possible for the interests principally concerned to evolve a working method which, adopted by mutual consent in conjunction with the granting of full trading powers, would give the public the benefit of the development accruing from this change, and yet safeguard the interests of the private traders by reason of the increased additional volume of business to be expected.

The rapid development of electrical methods calls for demonstration facilities by which the public can obtain advice and see electric power applied to their varied needs, without feeling the more or less direct obligation to buy which is experienced in a shop. Showrooms under the control of electricity undertakers can satisfy this need in a very complete manner and become every day more essential, the more so because the best results from the use of electricity are not achieved by merely regarding it as a substitute for some older means of obtaining light and heat.

Easy-payment systems could well be applied to installation work. Already very rapid expansion has followed their introduction in some districts, and the Committee feels that methods of overcoming the difficulty as regards the initial cost of the installation, by hire or hire-purchase systems, should be encouraged wherever the first cost of wiring is found to offer any difficulty.

In view of the great interest taken by the public in electrical applications and the immense service which a wider use of electricity can obviously render to the community, educational publicity has become to supply undertakings more than a merely desirable enterprise. In the case of undertakings owned by local authorities it is also in the nature of a duty to the public. Any doubts concerning the legality of expenditure on local educational publicity by local-authority electricity undertakers should be removed.

Some company distributors have drawn the attention of the Committee to the manner in which they are handicapped by the uncertainty of their tenure. So long as the length of tenure and the terms of purchase remain uncertain, it is practically impossible for many of the small companies to face large capital outlays, to contemplate extensions of their existing areas of supply, or to proceed on a proper basis with the development of a cheap supply for general domestic use.

The Committee is of opinion that statutory authority should be given to local-authority undertakers, enabling them to borrow for the provision of working capital, or, alternatively, to put aside a reasonable amount of the profits of their electricity undertakings for that purpose. There is a growing tendency to pay for certain capital works out of surplus revenue, particularly where the alternative would be a loan for a very short period. This is a sound practice.

The application by local authority undertakers of a surplus to the relief of the local rates should be discontinued or strictly limited, the general benefit of the public being more properly promoted by the application of such surplus to development works and to reduction in the charges made for electricity. The Committee recommends that electricity undertakings should be assessed on the basis of the profits of the undertakings, with a rebate of such a sum as would represent 75 per cent. of the sum payable on account of the general district rate in respect of underground cables and works.

Electricity at Textile Exhibitions.

The annual Textile Machinery Exhibition usually provides much of interest to the electrical engineer who is anxious to learn the latest in the application of his productions to the important clothing trades. This year the exhibition was held at Leicester, and whilst there was not perhaps the number of novelties which were shown at Manchester last October, there was very much of interest.

The Leicester Exhibition.

The Coventry Chain Co., Ltd., showed the application to hosiery machinery of a "Coventry" chain reduction gear box, combined with outside drive by roller chain to lineshaft, the whole being mounted on a combined base with an electric motor.

Messrs. Belliss & Morcom, Ltd., exhibited a high-speed forced-lubrication engine of enclosed type having high- and low-pressure cylinders designed for an output of 265 b.h.p. at normal load and 330 b.h.p. at overload. The "Arca" regulator was also displayed.

Messrs. Thomas Broadbent & Sons exhibited hydro-extractors both electrically driven and otherwise. The best type of electrically-driven machine has a totally-enclosed motor driving direct on to the spindle through a centrifugal clutch. The motor must have an exceptionally high starting torque with a reasonably low starting current, and this is obtained through the centrifugal clutch.

Fig. 1.—B.T.H. Stand at the Leicester Textile Exhibition.

The British Thomson-Houston Co. had a large stand, illustrated in fig. 1, showing various applications of electric lighting and power to the textile trades, primarily the hosiery industry. The motors shown included the "No-Lag" induction motor which operates at practically unity power factor over the entire load range. Small motors from ¼ h.p. to 1¼ h.p. for the individual driving of looms were also shown, together with a new line of a.c. and d.c. motors. The latter are fitted with roller bearings at the pulley end, and with ball bearings at the other. For single-phase a.c. circuits a repulsion-induction motor is provided. This is designed to start up easily under heavy load and to run at high power factor at a constant speed. Interest was shown in an equipment for operating a "Cotoon's" patent hosiery machine. This comprised a variable speed protected type motor, a drum type starting and regulating controller with a resistance range to start and provide speed regulation to suit the quality of yarn, and a narrowing switch. The maximum speed can be reduced in several steps to 25 per cent. below maximum, thus enabling the operator to select a suitable speed for special yarns and different atmospheric conditions.

The exhibit also included motor starters, control equipment, resistances, contactor-type circuit breakers, triple-pole double-break isolating switch, safety interlocks, &c. The Lighting Department showed various types of equipment suitable for the lighting of hosiery mills.

As an actual example of textile mill electrification the installation illustrated in fig. 2 is of interest. It was carried out by the British Thomson-Houston Co., Ltd., at a weaving shed in Lancashire. Each motor drives a line shaft through gearing and by ropes thence to a second shaft.

The Hoffmann Manufacturing Co., Chelmsford, exhibited a range of roller and ball bearings suitable for textile work.

P.I.V. Gear Syndicate, Ltd., exhibited two sizes of its standard totally enclosed gears. There was also an application showing the "P.I.V." chain used as a transmitter of power from one point to another as well as a means of accurate speed control.

The Manchester Exhibition.

The electrical features at the recent Textile Exhibition in Manchester were not very numerous largely on account of the comparatively small section of the display devoted to textile machinery. There were, however, a few features worthy of notice, and chief amongst these was undoubtedly the excellently arranged lighting of the mannequin stage, undertaken by the Metropolitan-Vickers Electrical Co., Ltd.

Two prominent firms of electrical suppliers exhibited, *viz.*, Thorwash, Ltd. (electric washers and ironers), and Electrolux, Ltd. (electric vacuum cleaners).

The large number of fabrics on show made the use of daylight lamps imperative in some cases, and it was a sign of increasing interest in lighting when exhibitors asked, as they did here in a number of cases, for daylight lamps to be fixed on their stands.

Messrs. Geo. Blackburn & Sons (Nottingham) exhibited rotary dyeing machines of American manufacture. An interesting feature of these is the "American patented panel control for the reversing of the cylinder. This control consists of sections, each of which governs a separate machine. Controls are mounted four sections in one stack, and each stack is driven by a pilot motor. On either d.c. or a.c. equipment, pressure of the starting button on the dyeing machine closes an automatic switch, and the drive motor, through resistance, starts up slowly. As the drive motor reaches its rated speed this switch transfers the operation to the revolving drum, which accomplishes the reversing of the drive motor, and through this the cylinder, the cycle of operation being continued until the stop button on the machine is pressed. Due to the construction of the drums, the current is cut off from the drive motor before reversing, which allows the cylinder to coast to practically a stop before the reversing energy is applied and the cylinder of the machine reversed.

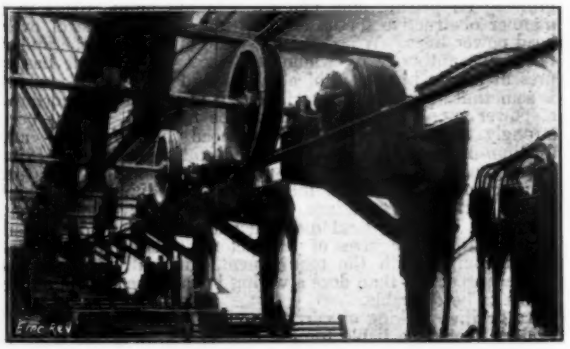


Fig. 2.—A B.T.H. Weaving-Shed Installation.

Other exhibitors were Messrs. W. & T. Avery, Ltd., the Skefko Ball Bearing Co., Ltd., the Universal Winding Co., G. & J. Weir, Ltd., Gledhill-Brook Time Recorders, Ltd., Ransome & Marles Bearing Co., Ltd., Joseph Stubbs, Ltd., Hans Renold, Ltd., the Midland Dynamo and Motor Repairs Co., Ltd., and the Superheat Furnace Co., Ltd.

Electric Vehicle Costs.—In a series of articles (commencing on September 16th) on the fleet of road transport vehicles used by Messrs. Hovis, Ltd., *The Times* gave the running costs of steam, petrol, and electrical vehicles, to illustrate in particular the efficiency of electric vehicles when they are well run. Messrs. Hovis employ three classes of machines and several types within those classes. Costs are given of steam wagons hauling 10 tons and of petrol and electric vehicles of 3 and 4 tons capacity. To be successful, an electric vehicle must, at present, perform the same duties as horse transport, largely because of its limited range, which for a 4 or 5-ton vehicle may be calculated at 50 miles. Messrs. Hovis have obtained from a 4-ton Walker, fitted with a three-year-old battery, as much as 52 miles. By giving the vans an extra charge during the middle of the day the mileage can be increased from 10 to 12 miles, but the transport manager, Captain Roberts, tries to limit the radius of deliveries to some mileage under 10, thus obtaining three full loads without an additional charge. For the steam and petrol wagons, weeks of work have been picked out of the records which most closely resemble the mileage and tonnage of the electrics. The whole makes useful and valuable comparison. It would appear that for hauls with a radius of 10 miles the electric lorry is second to none, while for a radius above that the steamer with its capacity for heavy loads or the petrol lorry drawing a trailer is clearly more economical. The figures show that the electrics are light on tires. It is stated that on one set fitted to the rear wheels of a Walker a mileage of 33,784 was arrived at. Electricity is obtained from the local electricity supply company, and the batteries are charged during the night. The maintenance figure is estimated, but is based on the experience of years. For depreciation Messrs. Hovis have taken the current-day price of these vehicles, wiping off the costs of the chassis and the body in eight years, and the battery in the same period. By this means the cost of running the vehicles under to-day's conditions is arrived at. The batteries are either of the nickel-iron-alkaline or of the lead type.

The Piezo-Electric Quartz Resonator.*

Its Equivalent Electrical Circuit—Proof of the Theory of its Application.

By D. W. DYE, B.Sc.

(*Abstract of paper read before the* PHYSICAL SOCIETY OF LONDON.)

THE quartz piezo-electric resonator, introduced by Mr. W. G. Cady, is examined experimentally and theoretically with special regard to an equivalent electrical system which can represent it.

Fig. 1 is a representation of a transverse section of a natural quartz crystal cut in a plane perpendicular to the optic axis; any such section contains three electric axes (shown dotted), at angles of 120 deg. to each other and parallel to the rectangular bounding faces of the crystal. A bar, or plate, is cut from the section with its length perpendicular to one of the electric axes as shown at AB; the dimension of the piece in the direction parallel to the optical axis of the crystal may be large or small: if it is small compared with the length AB we obtain a bar; if of the same order as AB we obtain a plate. If such a plate, or bar, is placed in an electric field applied in a direction perpendicular to its length, *i.e.*, parallel to the electric axis *ab*, the bar will experience two strains, one in the direction of its length and the other perpendicular thereto, *i.e.*, along the direction of the applied field. These two strains are of opposite sign, so that, if, for example, the bar becomes longer in the direction AB it becomes thinner in the direction *ab*. The two strains are such that the volume remains constant. The strain across the bar has been called the longitudinal effect because it is along the direction of the applied field although transverse to the length of the bar. If an alternating electric field is applied to the bar, it will be subjected to alternating stresses and strains both along its length and transversely thereto. If the frequency of the applied field is adjusted to coincide with that of one of the free modes of vibration which can be maintained by such alternating stresses, a large resonant vibration will occur. The amplitude of this vibration and its rate of change with frequency will depend upon the mechanical damping of the quartz and upon its piezo-electric reaction on the applied field. It is the very small damping coefficient and the permanence of form and constitution of natural quartz that render it specially valuable as a radio-frequency standard when suitably cut and mounted. It must be kept in mind in thinking of the various modes of vibration that a longitudinal vibration results from the transverse piezo-electric effect and *vice versa*.

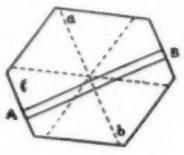


Fig. 1.—Cross-Section of Quartz Crystal.

A theorem has been enunciated by Mr. S. Butterworth relating to a dynamical system in which mechanical vibrations may be produced by the reaction of an electric system upon it; the mechanical vibrator may be replaced by an equivalent electrical oscillatory circuit coupled to the actual electric circuit in a manner depending upon the nature of the mechanical oscillator and the means whereby the transformation of electric into mechanical displacement occurs. The piezo-electric resonator is a mechanical vibrator falling within this class, and can be represented by inductance, resistance, and capacity in all series; they are pictured as in parallel with another small condenser and the whole as in series with a third condenser, the additional condensers representing air-gaps.

The resonator as usually mounted consists of a plate, or bar, of quartz in which the electrodes are separated from the surfaces of the bar by a small air gap. A very satisfactory method of using a resonator as a standard is that of Mr. Cady, in which the resonator with its electrodes is connected in parallel with the condenser of an oscillatory circuit tuned approximately to the resonance frequency of the quartz. A current-measuring device in series with the inductance coil of the oscillatory circuit indicates the sudden change in current occurring at the response frequency of the quartz. This arrangement is shown diagrammatically in fig. 2 (*a*) and the complete electrical equivalent system is as shown in fig. 2 (*b*), in which the piece of quartz itself is represented by N K and S shunted by K_1; the two air gaps are represented by K_2.

Experiments have determined the validity of the equivalent electrical network and given valuable information regarding the actual values of the equivalent constants N S and K and shown how these depend upon the properties of the quartz, &c. Actual effective values of K, S, N and K_1 experimentally measured in a typical resonator (a bar about 7 cm. long, 0.15 cm. thick, and 0.6 cm. wide) have been found to be: K = 0.08 $\mu\mu$F; S = 1,500 ohms; N = 160 henries. K_1 = 8 $\mu\mu$F; and ω_0 = 275,000 ($\omega_0/2\pi$ = true resonant frequency, defined by $N\omega_0^2 = 1$). The extremely small value of 1×10^{-4} is the log. dec. of the resonator with a good specimen of quartz. It is to be anticipated also that much may be learned regarding the constancy of these quantities with respect to the physical condition of the specimen and its surroundings.

*The investigation was carried out at the National Physical Laboratory for the Radio Research Board.

A striking agreement may be obtained between the observed current I_1 (fig. 2*b*) in the oscillatory circuit (to which the resonator is attached) as a function of the frequency of the source and the calculated current in terms of the determined constants N, S, K, and K_1; equally good agreement is also obtained between theory and experiment with respect to the current I_2 (fig. 2*b*) in the shunt circuit containing the resonator. The agreement holds for longitudinal resonators of as low a frequency as 44,000 and for transverse resonators of as high a frequency as 15,000,000 periods per second.

We will now turn to a consideration of the resonance curve of current in the inductance coil L of the oscillatory circuit LRC across which the resonator is shunted. It is this current which can easily be observed as a function of frequency, and of those other quantities in fig. 2 (*b*) which can be varied; by deductions from such observations we can arrive at a complete analysis of the constants K, S, N and K_1.

This system has flowing through it a current of which the instantaneous value is represented by i_s; it is shunted across the oscillatory circuit CLR, carrying the current having an instantaneous value i_1. An electromotive force e_0 (assumed constant) is induced in L by very loose coupling to a source of smoothly variable frequency as indicated. A fictitious current i_s flows in the quartz mesh itself, and cannot be measured, but is introduced for purposes of the algebra of the analysis; it has its counterpart in the physical reaction of the quartz. The root mean square value of i_1 is measured by heater and thermo-junction connected to galvanometer G_1; similarly I_2 is measured on G_2. This measurement is difficult owing to the smallness of I_2 and to the smallness of the energy circulating in the shunt system.

When the frequency of the source is smoothly varied through the region of response of the quartz, remarkable changes

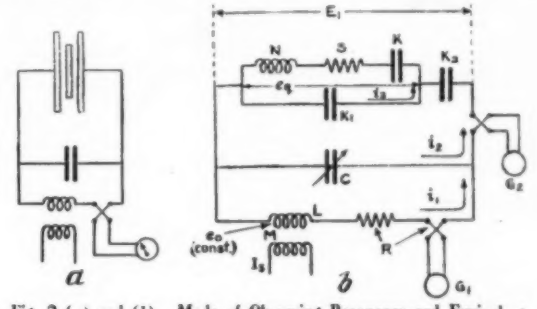


Fig. 2 (*a*) and (*b*). Mode of Observing Resonance and Equivalent Electrical System.

occur in the values of I_1 and I_2. Owing to the relatively large and sudden absorption of energy by the quartz at the frequency of response, the current I_1 falls very rapidly to a very sharply-defined minimum, and then rapidly rises again to nearly its previous value. The resonance curve of I_1, which, in the absence of the quartz, assumes a normal shape, has thus a deep and narrow crevasse (well known as a result of the work of Cady and others). The current I_2 rises to a sharp maximum, and suddenly falls to a small value again. The exact form of the curve I_2 and its location with respect to I_1 is, however, considerably dependent upon the conditions under which the experiments are carried out. It is shown how the logarithmic decrement of the resonator may be obtained from a rectified line plotted from observation of the current in the oscillatory circuit as a function of frequency width across the crevasse which pierces the summit of the resonance curve. Methods of analysing the equivalent mesh into its components are next developed by carrying out a series of observations of the current at resonance when the air-gaps are varied by known amounts, or by giving different known values to the effective resistance of the oscillatory electrical circuit.

Experimental and theoretical examples of curves show the extraordinary accuracy of the agreement which may be obtained and make clear the effects on the crevasse of varying certain conditions. Fig. 3 is an example of a curve of σ_1 for a resonator in the form of a bar approximately 6 cm. × 0.15 cm. × 0.6 cm., vibrating in its fundamental longitudinal mode at a frequency of approximately 44,000 cycles per second. The case given has been chosen and has been plotted on such a scale as to bring out various points. The curve has been purposely made unsymmetrical by slightly detuning the electrical circuit, which is in resonance at a frequency 64 cycles per second lower than the frequency where σ_1 is a minimum.

The flat dotted curve is the curve of current I_s in the oscillatory circuit that would have been obtained in the absence of the quartz. Owing to the open scale of frequency, the curve loses its more familiar shape, and what usually appear as a sharp peak is now a very rounded top. The whole belt of

frequency covered on this curve is 0.5 per cent. wide. The constants of the circuit and the air gap have been chosen so as to give a very deep crevasse having a minimum value of 0.128.

The curve has not been drawn through the points, but from an equation, and the observed points have been very carefully plotted afterwards. The agreement is very striking, and shows that within the accuracy possible experimentally the electrical behaviour of the resonator is exactly represented by the mesh of fig. 2. The two parallel dotted lines show a belt of frequency of width of one part in a thousand.

The frequency at which $\sigma_{1\ min.}$ occurs is almost entirely independent of the precise adjustment of the electrical circuit to resonance. The setting of this circuit can, of course, be made much closer to resonance at the desired frequency than 0.5 per cent. Although it is not always easy to set it to one part in ten thousand, it can always be set to one part in one thousand. For an uncertainty of this amount the uncertainty of the response frequency of the resonator will not be so great as three parts in a million.

The next curve (fig. 4) represents a resonator of much higher frequency and of a different type, in the form of a small rectangular slab 1.564 cm. × 1.640 cm. × 0.615 cm. thick, which is suitable for the transverse mode of vibration. This particular piece was chosen with special care and is very homogeneous and has a very small logarithmic decrement. It will oscillate readily when suitably connected up with a valve.

The curve corresponds to a nearly symmetrical case. The resonant frequency is approximately 472,000 and the log. dec. is only 0.8×10^{-4}. The main part of the crevasse is comprised within the belt of 1 in 10,000 embraced by the dotted lines.

The remarkable agreement between the observed points (dots in circles) and the calculated curve shows that for a transverse resonator the theory also holds within the experimental limits. The equivalent electrical constants of a given piece of quartz are, of course, quite different according to whether it is vibrating in a longitudinal or in a transverse mode, but in general the log. decs. are about the same and the value of κ, is not very different for the two modes of vibration; the damping coefficient for a short high-frequency resonator is not very different from that for a long low-frequency resonator.

As an extreme case, fig. 5 is a curve for a resonator of no less a frequency than 15×10^6, in the form of a small disk about 0.2 mm. thick and 6 mm. diameter; its mode of vibration is transverse.

Even at such a frequency the agreement between theory (drawn curve) and experiment (dots in circles) is satisfactory. In such a case the precise adjustment of the electrical circuit to resonance at the bottom of the crevasse is almost impossible owing to the smallness of the inductance and the capacity. The case shown is one in which the electrical circuit has a resonant frequency somewhat lower than the response frequency of the resonator. The experiments at such frequencies are difficult: special arrangements of the valve oscillator are necessary to enable smooth reversible changes of frequency of uncertainty less than one part in a hundred thousand to be made when the frequency is as high as 15×10^6 (20 metres wavelength).

Cady indicated that a change of resonant frequency of a bar is to be expected when the air gap is varied, due to the leakage electric field resulting from the vibration of the bar: the suggestion is that the vibrating bar is analogous to a bar magnet, and that the leakage field reacts upon the modulus of elasticity, thus altering the true resonant frequency. It is probable that this reasoning is true in part, but it must not be considered as the main cause of the frequency change. It may be quite definitely stated that, except for very small air gaps (less than 0.1 mm.) the main change in frequency consequent upon an alteration in the air-gap is due to the fact that the resonator behaves as an inductance of such value as to give the equivalent electrical resonance corresponding to the capacity κ_2 of the air gap. This is a very interesting fact, and requires further experimenting, using electrodes of smaller length than that of the bar, with a view to the experimental determination of the real change in the true resonant frequency as a function of air gap. The possible change in frequency is by no means negligible on a resonator if the air gap changes adventitiously. On the other hand, such a possibility of variation affords a convenient means of finely adjusting the frequency to a desired value when once the resonator has been ground to within one or two parts in a thousand in frequency. There is a range of about three parts in a thousand in a longitudinal resonator for reasonable limits of the air gap. In the case of a resonator vibrating transversely remarkable effects are obtained when the air gap is varied. For a narrow range of air gap extending from a very small total gap up to one of a few tenths of a millimetre, the change in frequency is smooth and of the same general character as that shown by the longitudinal resonator; the increase in $\sigma_{1\ min.}$ is also smooth and of the rate to be expected. At certain air gaps, however, the behaviour is quite rapidly variable. The frequency changes suddenly, becomes negative, and then positive again within quite narrow ranges of air gap. The values of $\sigma_{1\ min.}$ also show corresponding fluctuations. These effects suggest that the equivalent of a coupled resonant circuit is operating. There is no doubt that this is the case and that the effect is due to resonance of the plate of air between the surface of the quartz and the electrode. The effect recurs every time the air gap has a value which is an integral multiple of the half wavelength of the supersonic air wave corresponding to the frequency of the resonator. Thus, assuming the value for the velocity of sound in air of 340 metres per second to hold for such high-frequency air waves, then, at a frequency of 472,000 vibrations per second the half wavelength is $340{,}000/2 \times 472{,}000 = 0.360$ mm., a result in exact accordance with the observed value. The damping is enormously increased as a result of the greatly augmented air vibrations occurring in the space between the surface of the quartz and the electrode.

The effective value of ϕ_2 is increased twenty-fold owing to this large absorption of energy from the quartz. Whether the energy is wasted as viscous damping in the air, or whether it is radiated as an augmented air wave, I am at present unable to say. The equivalent electrical system will be that of a closed oscillatory circuit coupled inductively to the fictitious inductance N of fig. 2 (*b*) the change in frequency consequent upon a change in air gap is much smaller for the transverse than for the longitudinal resonator previously given. The total possible change from zero to an infinite air gap is less than one part in a thousand. Within close limits, therefore, it may be provisionally stated that the behaviour of a transverse resonator can be imitated closely by an equivalent electrical network, but that at certain values of air gap the resonator behaves as though an additional resonant circuit were coupled to the network representing the resonator. This resonant circuit must be considered to have a frequency so varied as to be proportional to κ_2 and to become equal to that of the resonator at those values of the air gap which represent integral half wavelengths in air of the frequency of the resonator.

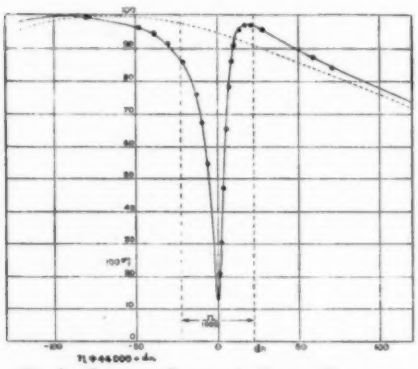


Fig. 3.—Response Crevasse in Current Resonance Curve for Longitudinal Resonator.

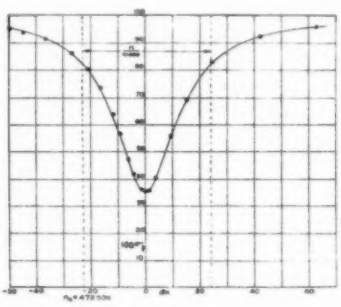


Fig. 4.—Response Crevasse of Transverse Resonator.

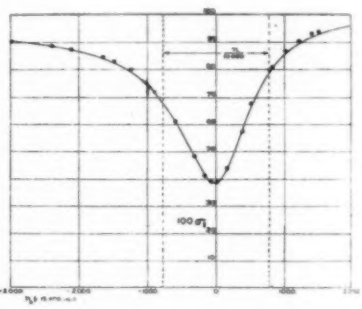


Fig. 5.—Response Crevasse of very High Frequency Transverse Resonator.

The temperature coefficient of frequency of a variety of resonators was examined with very diverse results: Three conclusions which may be drawn from these measurements of temperature coefficient are:—

(1) That the temperature coefficient of response frequency for a thin bar when vibrating longitudinally is small, and in a good specimen is of the order -5×10^{-6} per 1 deg. C. rise in temperature.

(2) The temperature coefficient of response frequency of a disk or plate vibrating transversely in the direction of the electric axis is of the order -40×10^{-6} per 1 deg. C. rise in temperature and is, therefore, by no means negligible. Values ranging from -30 to -70×10^{-6} have been observed.

(3) The temperature coefficient of response frequency of vibration in the direction of the optic axis is larger than either of the foregoing and may reach -80×10^{-6} per 1 deg. C. rise. Also in the case of a disk or plate in which the dimensions along the optic axis and along that axis which is perpendicular to it and to the electric axis, the temperature coefficients of all the modes of vibration are large.

The effects of displacement of the resonator from the position of centrality are small, but not quite negligible. The current taken by the quartz mesh is examined in detail theoretically

and a graphical method is given of deducing the curve of current from the constants of the quartz.

The conclusions to be drawn from the investigations would appear to be: 1. That an electrical network of the kind first suggested by Butterworth can explain in a general way the behaviour of a piezo-electric resonator, or oscillator. It may be mentioned in passing that before finally using Butterworth's system the writer had developed an equivalent system which explained the resonator; it is, in fact, interpretable almost exactly algebraically into the system of fig. 2. Further work is needed on resonators of larger capacity in order to elucidate the departures of the behaviour of the resonator from the predictions of the theory, in particular in respect of K_1, which is definitely different from its value at frequencies outside the belt of response owing to the self-induced electric field. In this respect it is probable that as found at the point of maximum response, K_1 really increases from this value to nearly its geometric value as the value of σ_1 rises to unity on each side of the crevasse.

2. The temperature coefficients of response frequency are not negligible except for longitudinal resonators of suitable shape. The coefficients are those to be anticipated from the known coefficients of Young's modulus with temperature. Further information regarding the latter could be obtained by a systematic investigation of the frequency temperature coefficients of resonators of various types and modes of vibration. Care would be needed to discriminate a possible effect due to a change in K_1 with temperature.

3. The simple theory developed accounts for those effects on oscillators which are common to resonators; it is probable that a more complete theory introducing the electrical equivalents of the valve and other associated electrical circuits would account for the further effects on frequency of oscillators consequent upon these circuits. Such effects have been studied to some extent, and are being pursued. Scope for considerable investigation exists in the case of oscillators, both from the theoretical and from the experimental points of view.

A considerable future awaits development in the application of resonators and oscillators as frequency standards, filters, frequency controllers, &c. This use at transmitting stations conjointly with the production of local heterodyne frequencies by them will permit of the production of an extremely constant frequency difference. This is an application that has considerable possibilities not yet developed.

The British Industries Fair.

The Electrical Committee getting to Work.

In connection with the Electrical Trade Section, at the British Industries Fair (Birmingham and Midlands), to be held early in the New Year at Castle Bromwich, Birmingham, a representative meeting of gentlemen identified with the electrical industry, and the trade Press, was held at the buildings of the Birmingham Chamber of Commerce on Wednesday, October 20th.

Col. Walduck, the president of the Chamber of Commerce, who presided at a luncheon which preceded the meeting, extended a hearty welcome to the visitors They were, he believed, thoroughly interested in the effort which was being made by the Management Committee to make the Fair a success. Personally, he thought it was within the grasp of the Committee to make the Fair at Birmingham bigger and more important than any of the Fairs yet held; and he was quite satisfied that that could be achieved, given the co-operation of the various trade organisations and the trade technical and general Press. The president proposed the toast "Success to the British Industries Fair."

Mr. T. R. Martin (chairman of the Fair Management Committee) replied. His hope was that the electrical industry would be thoroughly well represented at the Fair, and that the preliminary steps to secure adequate representation would be made that day. Success was achieved last year, despite the fact that the effort of the industry was made at short notice, but with organisation and co-operation by the various interests the success should be even greater. The Fair had a world-wide objective and the aim was to demonstrate to the world the fact that British products and British workmanship were unsurpassed. That demonstration could be made either by sending their manufactured goods abroad for the inspection of the overseas buyer, or by affording opportunities in this country for the latter to see British-made products. His belief was that the latter method was the better; and that by holding the Fair in the same place, year after year, a steady stream of buyers from abroad would be ensured. But it was essential that the Fair should be on a big scale and representative of our industrial life. He was aware that the time of the year at which the Fair was held did not suit the convenience of all engaged in the electrical industry, but he counselled the exercise of patience. It was well to remember that the Industries' Fair movement in this country was only just beginning, and he could visualise the time when there would be not only one Fair, but perhaps two or three fairs a year. To secure that was merely a question of time and patience; and when such arrangements obtained it might be possible for large individual industries to hold their sections at a particular time of the year. Having regard to the acknowledged high quality of British products, and the reputation of the British manufacturer for integrity, he would like to see constituted a national Board, operating as part of the Fair organisation, whose duty it would be to conduct a scheme of national advertising. At the present time 100,000 sq. feet of space had been let, as compared with 80,000 sq. feet last year. Considerable extensions to the Fair buildings at Castle Bromwich were being made. The Management Committee, working with the electrical industry, was most anxious that the efforts of the Advisory Sub-Committee of that industry should lead to a worthy representation among the standholders, of British electrical firms. Every assistance would be afforded that sub-committee, by the Fair Management Committee, in the arrangements for bringing buyers to Birmingham. Through that sub-committee, of which Mr. E. J. Jennings (secretary of the Birmingham Corporation Electric Supply Department, was secretary, official visits were paid to the Fair by representative trade organisations. He concluded by pointing out that the Fair was a purely business concern, but it also had an important bearing upon national trade.

Mr. Jennings pointed out that until 1926 there was no electrical section as such at the Fair; and that he regarded as a serious error. A year ago a trade sub-committee was formed, and its efforts produced an extremely representative show of the electrical industry. Eighty firms exhibited, and they hoped that that number would be exceeded in 1927. A small committee was appointed prior to the last Fair, consisting of the following: Mr. J. W. Beauchamp (British Electrical Development Association); Mr. F. J. Collis (Electrical Accessories Manufacturers' Association); Mr. T. R. Martin (the chairman); Mr. S. T. Allen (formerly electrical engineer of Wolverhampton); Mr. R. A. Chattock (President of the Institution of Electrical Engineers last year), and himself. Mr. Martin and he acted as a small working committee, consulting the Committee on matters of general principle. The gentlemen who served last year were willing to serve again. In addition to those names it was well to have a representative committee of the industry, and the following had expressed their willingness to serve upon it: Dr. Eccles, president of the Institution of Electrical Engineers; Mr. C. W. Sully, Electrical Lamp Manufacturers' Association; Mr. R. P. Sloan, president of the Electrical Development Association; Mr. F. A. East, president of the Electrical Accessories Manufacturers' Association; Mr. E. G. Batt (chairman of the Heating and Cooking Section of B.E.A.M.A.), and Dr. Railing, of the General Electric Co., Ltd. They were in touch with "Beama" and the Cable Makers' Association, and they would be meeting shortly to consider their policy with regard to the Fair. It was to be hoped they would be able to support that most important movement.

Dr. Railing emphasised that no effort should be spared to secure the active and practical support of the big associations in the industry. He believed that those manufacturers who exhibited at last year's Fair and had specialities, or something new to show, did well financially.

Mr. H. H. Berry, speaking as a manufacturer, observed that last year he became an exhibitor, at short notice, at the invitation of Mr. Martin, and from first to last his firm was entirely satisfied with the results. Although the Fair was held at a time of the year which his firm would not select were it a free agent, his own view was that the electrical section was an unqualified success. The policy should be to work together, and make themselves sufficiently strong that they might be able to persuade the Government to change the date of the Fair, or provide a second Fair within the year. He had increased his stand space at the next Fair

Mr. Rodgers (chairman of the Fair Management Committee, 1926) said he was satisfied that no effort would be spared to bring overseas buyers to Birmingham.

Mr. A. H. Bridge (Commercial Editor, the Electrical Review), speaking for the Trade Press, assured the Management Committee that that Press would give to the Fair movement their wholehearted co-operation. They gave their warm support last year, and he believed it had a very potent influence. He hoped that information would be forthcoming as soon as possible with regard to the firms which intended to exhibit in 1927. The publication of such information might have a good effect. He believed the electrical section of the Fair was destined to grow to large proportions and to become the one British annual electrical market which would benefit both home and export trade. It was important that someone should be appointed to call upon manufacturers; personal contact should supplement the work of the Press and the sending out of invitations. He wondered whether the Department of Overseas Trade had done everything it could to help the industry in bringing electrical buyers from different parts of the world. Could not the Committee and the Department of Overseas Trade co-operate more effectively in this connection?

The work to this end should be going on now. One effect of the dispute in the mining industry had been to stimulate the demand for electrical domestic appliances, and it seemed to him that that side of our production might well be emphasised at the next Fair to let the world know that although we were in a less favoured position than the American domestic electrical trade, our manufacturers were producing many lines which foreign buyers should see.

Mr. Beauchamp (British Electrical Development Association) agreed that a splendid purpose would be achieved if more attention could be given to the home trade, or more specifically the domestic side of the home trade. Hitherto, the stands had chiefly interested the technical buyer, and it occurred to him that something might be done to bring home more forcibly the non-technical aspects of the industry.

The Chairman stated that 70 firms had already applied for space. He promised that the question of the appointment of someone to interview manufacturers should receive early consideration.

The names of Col. Kent (Electrical Porcelain Makers' Association) and Mr. H. H. Berry were added to the Committee.

The Progress of the Campaign.

Discussion on Mr. Dale's Paper.

In our last issue we gave an abstract of a paper dealing with the E.D.A.-E.L.M.A. campaign read by Mr. V. W. Dale before the first E.D.A. conference of the season on October 15th.

Prior to the reading of the paper, the chairman, Mr. H. J. Miles, M.I.E.E. (president of the Electrical Contractors' Association) said that he regarded the whole scheme, in essence, as a contractor campaign. The activity of the contractors was at the very root of the scheme, and his Association had determined to back the campaign wholeheartedly. An open letter had been sent to the contractors of the country in September pointing out that an expenditure of £30,000 was contemplated upon a campaign not only to induce people to put in new installations, but also to modernise old ones. The chairman expressed the hope that criticisms would be constructive and not destructive, because the campaign was started and obviously could not be altered to suit general criticisms and personal preferences. It could be made a gigantic success if everybody in the industry put their shoulders to the wheel and urged forward the scheme by helpful practical advice and suggestion.

Mr. C. W. Sully said that the scheme was the first national campaign that had been backed by all sections of the British electrical industry. Therefore it was worth all the individual support that could be given to it. There were indications that the public was not getting all the information it desired with regard to the campaign. The author had pointed out that the scheme was not complete, and the endeavour that evening should be to see how the scheme could be made complete. It was apparent that the campaign needed something more than the initial push. He hoped therefore that there would be a rapid extension of the formation of local "Circles," particularly in the London and Home Counties area. The public were demanding the competition book and the industry must see that they got it.

Mr. Oldham said that a more effective means of bringing home to the people of London the objects of the campaign would be to divide London and the Home Counties into, say, 30 or 40 sections and engage halls in those areas where mass meetings should be held during the course of the campaign. It should be put to the supply and contracting authorities in those sub-divided areas that if they would contribute the small sum necessary for securing the hall and providing a pianist, and perhaps a vocalist, the E.D.A. would organise the meetings. That sort of thing was necessary in a district like his own where the charge for electricity was prohibitive for heating and cooking and such meetings would cause the people of the district to demand better terms from the supply company.

Mr. C. Hayes said that one way of getting the campaign known was to walk into as many electrical contractors' shops as possible and ask for a copy of the competition booklet. In his own small manufacturing firm he was distributing "Home Lighting News" to all the staff, and they were all talking about the scheme.

Mr. L. Gaster thought that the crux of the whole matter was to show the public where their lighting installations were wrong and how they could be put right. The public must be convinced that the electrical industry was taking a genuine interest in them and was not running the campaign merely for the sake of gain.

Mr. H. F. Simon asked whether the E.D.A. would be prepared to distribute small quantities of the competition booklet free of charge so that electrical contracting firms could pass them on to builders and others who, although not directly connected with the electrical industry, advertised in their shop windows that they did electric lighting, sub-contracting the work when they got it. Another suggestion was that the cover of the booklet should be printed in the form of an art poster and the electrical trade journals asked to publish it as a supplement once a month during the campaign. He wished from his personal experience to impress upon all contractors present the value of the campaign as a business getter. In helping it they would be building up the electrical industry for the future as well as increasing business at present.

Mr. J W. Beauchamp said he appreciated the method suggested by Mr. Hayes of going into any electrical contractor's shop they happened to see and asking for the booklet. That was being done in various parts with surprisingly good results. Apparently the campaign was making Mr. Simon's fortune, and therefore he proposed to let him go on buying the books at one penny each for distribution to his builder friends. As the books were apparently bringing Mr. Simon business he saw no reason for giving him a free supply of them. He thanked all those who were working to help the campaign forward and added that it was proposed to arrange to have the meeting of that evening repeated in London.

Mr. Ellersdale said there was still much room for the E.D.A. to act as an educational as well as a development organisation, because he knew of one electricity supply company which had refused to connect heating circuits at the moment. The excuse was the shortage of coal, but the gas company immediately came along and the whole place in question was now gas heated. In another case the representative of the supply authority had told him that they were not anxious to develop the cooking load as it loaded up their station at a period when it was undesirable.

Mr. W. E. Bush said that the statement was made that the lamp-makers hoped to sell more lamps as a result of the scheme. Frankly, they did. The number of lamps sold in this country was ridiculously small compared with other countries, and progress was slower than in any other country. If the lamp-makers sold more lamps, there would be more switches and cables and so on sold; there would be more wiring contracts; and, what was more important, they would be putting in that entering wedge for other types of electrical apparatus. It had been suggested that the campaign should be stopped because of the coal strike, but he regarded that as a completely wrong policy. There were at present 50 "Circles" where the supply engineers and contractors were sitting down week by week discussing development. That in itself was an achievement, but in another few weeks there would be 100. The electric house was a very important aspect of the campaign. Already there were three in operation and another dozen were well on the way. That was the cheapest form of propaganda because the house, the furniture, and the decorations could be obtained for nothing. All the industry had to do was to provide the electrical equipment and start it. The campaign had been commenced at a very opportune moment, because as the result of the Electricity Supply Bill proceedings in Parliament the public were being educated in what electricity was going to do for them.

Mr. J. Edgar (South Shields) said that the North-Eastern area committee had endeavoured to see how many "Circles" could be formed in that area and had come to the conclusion that 24 could be formed and, as a matter of fact, 12 were already in existence. In a week's time when the committee met again, he believed it would be found that the whole 24 had been formed. There were also three demonstration houses in the area and, generally speaking, he felt that the Committee in the North-East area had done well. In connection with the scheme generally he urged supply engineers to consider seriously some form of assisted wiring. When he described his own scheme before the Association last year he was criticised to some extent because he had only made provision for lighting, and one small plug, so that an iron or a similar piece of apparatus could be used. The wisdom of that policy was really confirmed by the campaign now started because it was recognised that it was necessary first of all to get lighting into the houses, after which other uses of electricity quickly followed. The success of his own scheme was demonstrated by the fact that whereas at the end of March in South Shields there were 3,434 domestic houses connected to the mains, since that date, owing to the assisted wiring scheme, an additional 10,000 houses had been connected. That, at any rate, was one step towards wiring the homes of Britain.

Mr. E. J. Riley said that although the number of booklets purchased so far was satisfactory, it must be recognised that their ultimate destination was the public and every step must be taken to see that the booklets reached the public. As an indication of the competition still to be faced from gas, he mentioned the case of the electric lighting of a new arterial road in connection with which it had been stated in the local paper that the gas company had no idea the electrical supply authority was quoting for the work, otherwise its price would have been entirely different.

Mr. Dale said that the E.D.A. had prepared a lecture book in connection with the campaign which it was ready to supply, and there were scores of opportunities throughout the country for addressing the public on the campaign in an interesting manner. There were also lantern slides for the same purpose. He spoke with appreciation of what had been done in the North-East Coast area. Instances were mentioned of 66 per cent. and 77 per cent. "saturation," and in one Durham village it was stated that 95 per cent. of the houses were using electricity. There was, however, within 15 or 20 miles of London, an estate of 1,300 houses which had a saturation factor of 100 per cent. It had been demonstrated to be a practical possibility for every supply authority to run a demonstration house during the campaign. The engineer at West Hartlepool had opened a demonstration house on the first day of the campaign, and he (Mr. Dale) had visited another demonstration house in Gosforth. A subsidy house was being opened and it was interesting to get different classes of houses fitted as demonstration houses in order to show what could be done. In conclusion, he asked all those who were able in any way to help forward the campaign, to communicate with him, when he would put the district officer in touch with them at once.

The Institution of Electrical Engineers.

Inaugural Address by Dr. W. H. ECCLES, President.—*(Abstract.)*

In the *Journal* of the Institution will be found valuable papers dealing with every aspect of electricity. This close contact with the whole of the practice and science of electricity is the surest sign of the health and strength of the Institution.

I propose to trace and compare the main lines of present-day electrical development as they present themselves broadly at the moment to the electrical engineer; to see whether our country is, in comparison with other countries, flourishing and progressing, or lagging and flagging; to see how we, as an Institution, may help forward the nation's welfare.

The outstanding feature of the electric supply of the world is its tendency to concentrate into big units of management and production. This tendency was clearly visible in America before the war; in Europe it was forced on by the war and its economic consequences. France, Italy, Germany, Switzerland and Scandinavia have been the busiest regions, and Italy, Switzerland, Norway and Sweden, were compelled by the cost of fuel and freightage to develop their water-power resources energetically. France, Germany and Belgium were compelled, by the loss of many of their hard coal areas, to press forward with both the utilisation of water power and the most efficient utilisation of fuel. In all these countries electrification was pushed forward, among other reasons, because there was impulsion due to the instinctive feeling that modernisation of the basic industries was impossible without previous electrification on a national scale.

In estimating the relative electrical progress of the nations, one of the favourite figures for comparison is the consumption per head of population. By itself this comparison is not sound.

Our consumption per head is less than one-half of that of the United States. Another comparison may be obtained by taking the most fully electrified industrial areas of each country. On this reckoning the Newcastle area shows an annual consumption per head of about 600 kWh, which is one-third of that for similar zones in America. Still another comparison is offered by the average price at which electricity is sold in different countries. Table A gives the figures for 1925; this is very disparaging to this country, but it is somewhat unfair. Many private industrial generating plants in Great Britain have been ignored, and the taking of an average conceals the fact that in many instances the cost of electrical power in this country is as low as in the corresponding areas in America or Switzerland. Industrial energy is now sold in the Newcastle district, Lancashire, the Clyde Valley and other places at prices about the same as those of the cheapest power in America, excepting only the Niagara Falls and the Mississippi Power Company's areas.

TABLE A.

Price of Electricity, 1925.

	Pence per kWh sold.
Great Britain	1.90
United States	1.53
Canada	0.72
Switzerland	0.60
Northern Italy	0.40

A method of comparison which offers an important lesson consists in finding for various countries the kWh of energy delivered, on the average, by each kW of machinery installed. Taking all the central stations in four countries we obtain Table B. A more just comparison is that of Table C, in which, from each of five countries, a number of the largest undertakings sufficient to make up a total annual output of 2,000 million kWh have been taken, and the output per kW of plant tabulated. The figure of 1,730 kWh per kW for Great Britain indicates that we are getting only 4¾ hours' work per day out of the machinery in a number of our best stations. It will be noticed that the figure for Germany has risen from 1,540 in 1913 to 3,460 in 1923. The conclusion that we in this country are not getting full value from our installations is confirmed by finding the number of kWh sold for each pound sterling invested in stations, transmission lines and distribution networks. In 1925 America obtained 35 kWh per annum, and Great Britain 28 kWh from each pound sterling invested. The reasons for the position of Britain in this matter are the smallness of the machines and stations and the rigid separation of the undertakings. The recent change in the German position is due to the installation of larger equipment, combined with thorough interconnection; in some areas special advantages have arisen from the interconnection of hydraulic and thermal generating plants, on a scale not possible here.

TABLE B.

KWh delivered annually per kilowatt of plant installed.

	kWh sold, 1923. Millions.	kWh per kW.
United States	38	2,700
Italy	4.9	2,640
Switzerland	2.0	2,430
Great Britain	3.8	1,220

TABLE C.

KWh per kW installed for output of 2,000 million kWh per annum.

Italy (5 companies of Edison Group) ...	4,250
Germany (2 companies)	3,460
United States (1 company)	3,430
France (3 companies)	2,040
Great Britain (17 companies)	1,730

In Britain the total capacity of authorised undertakings has increased from 2¾ million to 4¾ million kW during the past six years, and the average annual rate of increase of consumption has been 14 per cent., which compares with Germany's 25 per cent. and Italy's 35 per cent. between the years 1921 and 1925.

It is sometimes thought that electrification has advanced rapidly in foreign countries because natural facilities for hydroelectric generation of power make electricity cheaper than in Britain. It is true that our water power resources are very small—only about one million horse-power—which is much smaller than the figures of our chief commercial rivals; but it is to be remarked that Belgium, which is more highly electrified than Britain, has no hydraulic stations, and that Germany generates only 10 per cent. of its electricity hydraulically. The fact is that the cost of transmission limits severely the region to which hydraulic power can be delivered cheaply; and the districts favoured with very cheap electricity are limited to the neighbourhood of Niagara and the margins of great mountain masses. It is cheaper to generate from imported coal in South Sweden than to transmit from the mountain hydroelectric stations of that country.

There is a continual struggle between thermal plant and hydraulic plant. As fast as hydroelectrics have been developed the efficiency of thermal plant has risen and the net cost of fuel per kWh generated has fallen. Twenty years ago condensing engines with an efficiency of 10 per cent. began the struggle, and now large steam turbines with an efficiency of 20 per cent. continue it. In countries where thermal and hydraulic generation might compete—such as Italy with 80 per cent. hydraulic, Sweden 75 per cent., the United States 34 per cent., France 50 per cent., and Germany 10 per cent.—an increase of steam-engine efficiency to 25 per cent. would reduce the area of profitable transmission of hydroelectric power to one-half of its present value, were competition allowed. Even if no such increase of efficiency matures, the promise held out to-day by high-pressure high-temperature steam, pulverised fuel, and the sale of by-products, justifies the opinion that thermal generation will continue to be more economical than hydraulic generation in most of the existing industrial areas of the world.

If our backwardness in electrical development is not directly due to the lack of water power or lack of fuel, what is it due to? It seems that there is a complex of primary causes, economic and political, but the chief electrical cause is our neglect to use the principle of interconnection for cheapening supply. This neglect has been due, in turn, partly to the stiffness of our national organisation, and partly to the cheapness of coal and transport. As Mr. Woodhouse pointed out in his address to this Institution two years ago, it is cheaper to rail coal from South Wales to London than to transmit electricity the same distance—therefore we were content. Another, but electrically less important, reason why we have not developed cheap universal supply is that many of our installations are not efficient as judged by modern standards. The average efficiency of the generating plant of the United States in 1923 was 17 per cent., and of the United Kingdom 12½ per cent., which indicates that we are wasting 27 tons of coal out of every hundred. But the inefficiency, regrettable as it is, does not greatly increase the price of electricity—the cost of distribution is unavoidably large—and therefore the low efficiency of machinery is less a hindrance than the lack of interconnection or co-operation between generating stations, which is the chief cause of our delayed development.

Centralisation and interconnection are the two main principles of the organiser who is going to cheapen electric supply. Both of them have been applied logically during the past five years in the creation of the great power zones of Germany and other countries. In Germany the Rhineland-Westphalian power zone comprises interconnected stations of a total capacity of not less than 1,500,000 kW and an annual output of 3,000 million kWh; the Central zone, extending from Berlin to Lower Silesia, comprises interconnected stations of about 600,000 kW capacity, which is to be increased to 1,500,000 kW within three years, with an ultimate annual output of 3,000 million kWh. The Bavarian power zone may be reckoned at 700,000 kW (of which 600,000 is water power) and produces more than 1,500 million kWh per annum; the Wurtemburg zone, now 250,000 kW, is planned to exceed 400,000, and to have an annual output of 800 million kWh. At present this zone is importing power from Switzerland. All these power zones are now being connected into one great national system.

In France the largest zone is that of Paris, served by generating plant of over 800,000 kW capacity; the Northern zone is 425,000 kW, and other zones are rapidly developing

water power in the mountain areas. Some of these zones are already interconnected. In the United States the Chicago and North Illinois zone has plant exceeding 1,000,000 kW capacity, much of the plant being massed in super-stations.

In Britain one of the zones of largest plant capacity is that of the London Power Company, about 250,000 kW, which sold 358 million kWh in 1925; three of the seven generating stations are over 50,000 kW each. The Newcastle Company controls over 260,000 kW, the Glasgow Corporation over 167,000, and the Birmingham Corporation over 133,000. These are some of the largest zones in this country. The largest single station is Dalmarnock, which has a capacity of 131,250 kW. It is probably not practicable to erect stations much larger than this in Britain because of cooling-water and other difficulties.

These figures serve to show what progress has been made in Britain during the past few years towards the advantages of centralisation and interconnection. The largest of our stations are practically as efficient as the greatest of the foreign super-stations—Barton, for instance, has reached 22 per cent. Interconnection has been proved profitable, notably in the Clyde Valley and Lancashire areas, but much remains to be done—the national load factor is still less than one-half that of some other countries, and the area of country adequately served is less than two-thirds of the whole.

Information respecting our use of electricity in industry is vague, but it has been estimated to have been 33 per cent. in 1924. In Belgium the proportion is 61 per cent., in Germany 60 per cent. and increasing, in America 68 per cent. In Britain the private industrial generating plant is more common than abroad, but conversion to public supply has begun where it is justified. The conversion in Germany during the past few years has amounted to an avalanche, and in France the vast development of public supply has fertilised every industry to such an extent that instead of being a customer of Great Britain, France has become an international rival in machinery and textiles. The industrial consumption from public supply in Britain, which is 68 per cent. of the whole output, is increasing at the rate of 18 per cent. per annum, and will increase faster as electrical power is cheapened.

In every country the railways should be one of the principal users of electricity, but only in Switzerland do we find main-line electrification well developed. There electrification was undertaken on a large scale because it aided general electrical development and electrical manufacture at a critical period, and because water power could thus replace coal; at present 1,750 miles of main line take 14 per cent. of the electrical power consumed in Switzerland. In France the Midi and the Paris-Orleans lines are partly electrified already, and these will co-operate with the P.L.M. in making a revolution of the transport of France. Germany and America are not much ahead of Britain in this matter, and opinion in these countries, supported by Mr. Roger Smith and other authorities in this country, is that the substitution of the electric for the steam locomotive cannot make much difference in the cost of working a main-line railway. This accounts for there being only 115 miles of main line electrified in Great Britain. But this is not the national aspect of railway electrification. As Mr. Merz has pointed out, the wholesale electrification of the main lines of Britain would help in the financing of the national interconnection networks, and would extend electrical facilities into areas otherwise unavailable as modern factory sites.

But although electric propulsion is not yet proved to be cheaper than steam on main lines, it is supreme on suburban railways. The extent to which it has been applied in various cities may be seen from Table D.

Table D.

Suburban Electric Railways.

City.	Miles of permanent way.	Car miles per annum.	Passengers carried per annum.
New York	622	282	1,713
London—			
Underground ...	139	65	318
Metropolitan ...	86	24	105
	225	89	423
Paris—			
Nord-Sud	—	8.7	89
Metropolitan ...	76	59.0	529
		67.7	618
Berlin	31	28	—
Hamburg	—	9.1	88
Madrid	16	—	30

Two forms of road transport utilise electricity, the tramcar and the free vehicle. In the development of the tramcar we take, I believe, quite a satisfactory position among the nations; but the free vehicle, especially the battery type, is less encouraged here than abroad. Of these vehicles the electric lorry deserves special notice. It is estimated that there are about 18,000 such lorries at work in America and only 1,000 here. American experience shows that the battery vehicle is more economical than the petrol vehicle for short-distance work—in fact, the running costs are about half those of other motor trucks—and that it is displacing the horse-van in cities. It is doubly regrettable that a form of transport which avoids the importation of fuel from abroad and which positively improves any load factor, is so neglected in this country.

The preceding paragraphs relate to industries that use electric power for driving or propelling, but there is a great class of modern industries which uses electricity in a different way, namely, the electrometallurgical and electrochemical industries. It is difficult to obtain statistics of the consumption by these industries in Britain, but one of the most important of them is the aluminium industry.

The electrochemical industry, of which the most important branch is the fixation of atmospheric nitrogen, is centred mainly in the new works at Billingham, and is now firmly established. Synthetic ammonia and nitrates are beginning to appear in our exports. In 1925 the electrical production of ammonium sulphate exceeded 300,000 tons, and therefore rivalled the by-product sulphate. In the production of calcium carbide and its derivatives, however, we cannot compete with the great water-power countries. The import of calcium carbide in 1924 was of value £530,000, mostly from Norway, Jugo-Slavia and Sweden, and the export of our own manufacture was only £17,000; of cyanamide, the import was £16,000 in value and the export negligible.

(To be concluded.)

Correspondence.

***Correspondents should forward their communications at the earliest possible moment.** No letter can be published unless we have the writer's name and address in our possession.*

The Remuneration of Electrical Engineers.

The writer raised the above question several months ago, and cannot refrain from replying to your correspondent "Chief Engineer." I am chief engineer in my own establishment, and therefore feel a trifle ignorant at not being able to "get" your correspondent's joke about daughters of a local grocer. Has "Chief Engineer" ever tried offering £300-£400 per annum for a highly trained engineer? If so, he must have been very unfortunate indeed in not finding his man with less trouble. It seems strange, in his particular case, that only three per cent. of his applicants appeared suitable. Did "Chief Engineer's" applicants apply personally, or in writing? If personal application was made, the "Chief" must have lost his temper when the 97th applicant appeared. If the applications were made in writing, "Chief Engineer" is a super-chief if he is able to judge an engineer's capabilities by the type of letter written. Personally, I am unable to judge any man by diagnosing his handwriting, or his written remarks.

Engineer.

October 16th, 1926.

Referring to the correspondence on the above subject, "Chief Engineer," in his letter, states that there are seldom three applicants out of every hundred, judging by their applications, that are suitable candidates for positions worth £300-£400 per annum in the electricity supply industry.

This is a very sweeping assertion to make in view of the large number of hardworking experienced men holding junior and subordinate positions in the industry. Has he, I wonder, ever taken the trouble to seriously consider and investigate this problem, or is he too busy attending conferences and devising fancy tariffs to devote any time to so trivial a subject? It is not every suitable applicant for a post that is in a position to comply with the conditions of the advertisement, *viz.*, to mention one, "three recent testimonials." Some chiefs will not give testimonials to their staffs, so that if a man has stuck to his job for any length of time, it is impossible for him to produce a testimonial at all. Moreover, if a prospective employer does trouble to take up a reference, will his present employer push the claims of a man with whom he may be loath to part, or whose job it may be troublesome to fill satisfactorily?

This gives a great advantage to those who have been birds of passage, and are able to produce high-sounding testimonials of doubtful origin, signed by some complacent, and possibly personally interested, chief engineer. If "Chief Engineer" were to make a few careful inquiries at a personal interview with some of the hitherto dispised and rejected ninety-seven per cent., he might find the man he requires. Also, by a well-thought-out examination, designed so as to discover the administrative, and/or executive abilities of the candidates, much of the haphazard guesswork of making appointments would be eliminated, without perceptibly adding to the cost of the kWh.

Surely the obvious way is to make a personal trial, and not rely too much on the recommendation of others, whose judgment may be prejudiced, or even in some cases valueless. Any man genuinely anxious to improve his position by honourable means would willingly submit to such an examination.

As one who has had 25 years' experience in the electrical industry, including generation, distribution, and installation, and has carefully followed all the various developments that have taken place during this period, I can speak with some feeling when I say that I have made application for very many appointments during the last 20 years, all of which I felt competent by reason of education, training, and experience to fill, without even being granted a single interview.

In quite a number of cases it has come to my knowledge that a candidate has been selected from a hundred, or more,

applicants on account of most convincing testimonials and has proved utterly unsuitable for the job, or has been discharged for breach of trust, or some defect of character.

May not the present chaotic state of the electricity supply industry, especially some of the smaller undertakings (though the larger ones are not all exempt) be in some measure due to the apparently generally recognised manner of making appointments to the staff?

A more useful asset than abilities, training, experience, and character to secure personal advancement appears to be an influential relative, or friend, or else the ability to "tell the tale," and to write, or have written, forceful letters, beautifully typed to impress local committees and chief engineers.

Like other correspondents on this subject, I prefer to remain anonymous and sign myself,

Worker.

October 17th, 1926.

Electric Steam Generation.

I notice in the ELECTRICAL REVIEW dated August 20th, No. 2543, an article entitled "Electric Steam Generation," on page 292, and at the bottom of the first column it is stated that:—"Of course, only alternating current can be employed, as direct current would decompose the water into oxygen and hydrogen."

This is surely an error, as alternating current will also decompose the water into oxygen and hydrogen, the only difference being that oxygen and hydrogen will be given off at both electrodes, whereas, with direct current, oxygen would be given off at one electrode and hydrogen at the other.

The author states that this type of electric boiler has already been used, but should the water level at any time fall below that of the electrodes, thus possibly causing an arc to take place, the result would be interesting, as the boiler would contain a considerable volume of oxygen and hydrogen in the proportion of

H_2O.

Calcutta, India, *September 30th*, 1926.

The Design of Overhead Lines.

The article in your issue of October 15th by Mr. W. E. Poole, on the "Structural Design of Overhead Lines," deals with the spacing of conductors in a novel and interesting way. I should, however, like to draw attention to the assumption that is made for clearance between two conductors in the vertical plane, namely, that one of the conductors may be carrying the full ice load specified by the Electricity Commissioners, and the other no ice, resulting in a minimum clearance of from 22 to 26 inches. This assumed condition is not usually experienced in practice when ice loading occurs.

The more frequent type of ice loading is that in which the same conductor may be fully loaded in one span and is carrying reduced ice loading, or is entirely free from ice, in the adjoining span; for even if the conductor is initially evenly covered with ice, uneven loading occurs during the period of thaw.

Similar conditions sometimes occur with birds congregating on one span in large numbers.

Under these conditions the conductor slips through the binder towards the loaded span (or the insulator string swings over with suspension-type insulators), but should the binder hold, the channel or bracket supporting the insulator will twist or bend in the same direction. This results in a considerable increase in sag of the loaded span and a reduced sag in the more lightly loaded span, which tightens up, and the worst condition is that of two adjoining spans, say, "A" and "B," where the top conductor in span "A" is ice loaded, but the other conductor in the same span below it is unloaded; while in span "B" the reverse conditions hold good.

For this reason conductors in the vertical plane should always be avoided unless much greater spacings can be allowed than is indicated in this article.

C. Vernier.

(*Mains Engineer, Construction Department*, NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.)

Newcastle-on-Tyne, *October 23rd*, 1926.

A New Type of Electricity Meter.

Under the above heading in your issue of October 1st, 1926, is described a meter which registers, in addition to the energy used by the consumer, the cost of one of several alternative services.

Without commenting on the increased size and weight of the meter, I will pass on to consider the proposed means of achieving the distinctive function of this instrument. An extra pressure element is fitted which provides the torque for the no-load rotation. This element absorbs constantly about 1.5 watts, but the supply authorities need feel no uneasiness in this respect because, as is explained, "it can be included in the registration" and presumably nobody need make a fuss about it. This should herald the opening of a new era in meter engineering, and henceforth, instead of manufacturers exercising scrupulous care in minimising the wattage loss of the pressure element, they will be able complacently to include it in the registration.

The continuous rotation on no-load is described as of constant speed. It would be interesting to know if this constancy of speed presupposes a perfectly steady supply voltage, and a perfectly frictionless rotor and train in a meter of low torque.

The accuracy curve given is very interesting, and, whoever pays for the extra 1¼ watts lost, this accuracy curve requires compensating; for instance, take a 2½-amp., 200-volt meter on 1/20th load, i.e., 25-watt load. By this meter, we get 25 watts registered, and 26.5 watts supplied, or a meter reading approximately 6 per cent. slow, whereas in an ordinary meter, the error in curve is of the order of 1 per cent. slow at this point.

It seems to me a somewhat fatuous procedure to first determine accurately a certain charge, and then to vitiate a meter to register this charge approximately, when a bill for the amount first determined would state the charge with 100 per cent. accuracy; but what is the object of this approximate measurement of a fixed charge?

The supply authorities will be thoroughly conversant with whatever system of charging may be in vogue, and, in the case of a two-part tariff system, they require no enlightenment as to the honesty of a demand for an amount which is in excess of the cost of the units actually registered. I can only conclude that the employment of no-load running in meters, other than of the prepayment type, is an expedient to accommodate the consumer who compares his bills with the units registered on his meter dial; but I fear that this same consumer would be clamorous in his demands for an explanation as to why his meter continued to register when he was taking no load. Perhaps it would be easier to convince such a consumer of the equity of the fixed charge over and above the cost of units registered, than it would be to pacify him with respect to the constantly rotating disk.

In conclusion, may I point out that the meters would require calibrating to suit each consumer, and that in the event of a change of the fixed charge for the district, it would be necessary to recalibrate each meter for every house instead of simply altering the amount of the fixed charge on the usual bill.

Anticreep.

October 20th, 1926.

The Lightning Rod Act in Ontario, Canada.

I have to thank Mr. E. Isherwood for his interesting and lucid explanation of his shallow-earth theory, but he has not yet convinced me that the deep earth is not necessary in the cases I mentioned. The mere fact that thunderstorms *are* so rare in deserts would seem to indicate that there is no surface induced charge to provoke them, as all other conditions would appear to be favourable. Nor can I agree with him in the instance he gives of dry stone buildings being immune from danger as disproving my contention that the induced charge is at a lower stratum. I think it is reasonable to assume that a lightning flash, passing from a cloud to the surface of the earth in the neighbourhood of a dry stone building, would prefer to pass *via* the building, the impedance of which would probably be much less than that of an alternative path through the air, although the induced charge may have got no higher than the surface of the earth in the vicinity of the building.

It seems to me that there are not the same conditions to be considered in the case of the isolated building as there are in the case of a building situated in a town. In a town the induced charge may be considered to be always at the surface of the earth, but in the case of an isolated building it may, or may not be, according to conditions prevailing at the time.

In towns, I agree that a deep earth is not necessary, owing to the fact that although the earth itself may not be readily conductive, yet the movement of the induced charge is facilitated by the network of gas and water pipes, electric cables, drains, &c., comparatively near the surface, and the safest earth connection in this case would be to the water main itself, or the method suggested by Mr. Isherwood. The Phœnix Fire Office apparently recognises the two separate conditions, as it gives two alternatives for earthing lightning conductors, either connection to a water main, or an earth plate carried down to permanent moisture. I think Mr. Isherwood would also object to the water main earth, as, owing to the wide area covered, this would "tap other charges and simply increase the p.b.s."

Mr. Isherwood's remarks regarding radio aerials seem to support an opinion I have held for some time, namely, that aerials should not be earthed when not in use, or when thunder is prevalent, as this tends to draw a disruptive discharge upon them that they cannot possibly cope with. A lightning discharge falling upon an earthed aerial would almost certainly destroy it and seek an alternative path through the building. Greater safety would be achieved by simply isolating the aerial, or providing it with a spark-gap to earth. The fact that various fire offices ask for earthing switches to be fitted to all aerials would appear to indicate that my opinion is wrong, and I should be glad of Mr. Isherwood's views upon the subject.

T. C. Gilbert.

(*Managing Director*, T. C. GILBERT & CO., LTD.)

Folkestone, *October 17th*, 1926.

[Our correspondent's remarks about radio aerials are certainly interesting. His suggestion that greater safety might result from providing an aerial with a spark-gap to earth seems feasible, but simply isolating it might cause a spark discharge from its free end.—EDS. ELEC. REV.]

"Intercom" is requested to forward his name and address.

Indian Electrical Notes.

(From Our Indian Correspondent.)

The Bhagalpur Electric Supply Co. has been formed for the purpose of supplying electricity for all purposes in the town of Bhagalpur. Bhagalpur is the second largest, and, industrially, the most important town in the Province of Bihar and Orissa. It lies on the south bank of the Ganges on the East Indian Railway, and has a population of about 100,000. There is a connection with the B. & N.W. Railway *via* a *ghat* across the river. The prospects of the undertaking are regarded as very favourable. Bhagalpur is the headquarters of a district, and is a very wealthy city. It is anticipated that the Courts and other Government offices established there will be consumers of considerable value to the company. In addition, the results of a house-to-house canvass have shown that the company will be well supported by private residents in the city, a very large number of whom have expressed their intention of using electric light and fans as soon as energy is available. There is a large grain mart at Bhagalpur, and there is also a large flour mill and several oil mills in an area close to the railway station, which area is reserved for industrial purposes. Certain additional mills are now in contemplation.

A water supply scheme for the town has been designed, and is expected to be taken in hand in 1927 with Government aid. This scheme will be worked by means of electric pumps, and it is anticipated that the load will be a substantial asset to the company. The municipality is also anxious to use electricity for street lighting, and this source of revenue should increase as time goes on. There are a certain number of small independent power stations in the area for which licences have been granted, but it is expected that these will be closed down when a public supply is available.

It is anticipated that, as in the case of other Indian towns, as soon as electric power is available a certain number of small mills and industries will spring up, and that the company will in due course earn a considerable revenue from this source. The largest prison in the province is situated at Bhagalpur, in which a large power-worked blanket factory exists, and it is hoped that this will take electricity from the company, both for lighting and power.

It is proposed to construct and equip a power station, worked by Diesel engines. The work will be carried out under the supervision of the managing agents, Messrs. Octavius Steel and Co., Ltd., Calcutta. The authorised capital of the company is Rs.12 lakhs. The capital expenditure upon the scheme as outlined at present will be Rs.7 lakhs.

Calcutta Broadcasting Station.

To establish a broadcasting station in Calcutta, which the Indian Broadcasting Company proposes to do, the company requires an area of five *cottahs* of land as a site for the erection of two masts or towers and a transmitting station, and a further area for the construction of an "earth" system. Negotiations are now pending for a site in the Cossipore-Chitpore Park, which the Improvement Trust is constructing. It is understood that if the scheme matures, the broadcasting station will be of similar capacity to that of London. The transmission masts will probably be 150 ft. high, and of graceful structure so that they will not be likely to detract from the amenities of the park. It is proposed that the transmission station shall be of ornamental and approved design. Terms between the company and the Improvement Trust have not yet been definitely arranged, and even if the scheme is carried through it will be of a purely experimental character, its permanence depending upon its success as a commercial venture.

School Children and Electrical Dangers.—The Electrotechnical Committee of Czecho-Slovakia has recently drawn up a series of "ten commandments" for school children, which are intended to be posted up in schools to warn them against the dangers of interfering in any way with electrical installations. The commandments are as follows:—

1. Do not climb masts or other posts supporting electric wires or any trees in their vicinity.
2. Don't swing or hang on to any electric wires or cables, and don't shake them.
3. Don't climb up transformer cabins or boxes; should they be accidentally open at any time don't enter them or place anything in them.
4. Don't throw anything at porcelain insulators or on electric wires.
5. Don't fly kites or play football in the vicinity of electric wires and cables.
6. Never touch any electric wires or cables, even when they have fallen on the ground.
7. If you see anyone struck down by contact with an electric current, don't go near him while he is still in contact with the wire, but run for someone older.
8. Don't interfere with any part of an electrical installation—fuses, interrupters, &c.—you may do yourself harm as well as damage the installation.
9. Don't attempt to repair any electrical installation; simply point out any defect to the person in charge.
10. In interfering with and damaging any electrical installation you are not only causing danger to many people, but are running the risk of being killed yourself.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 20th:—

Rhapsody. No. 472,894. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—R. May, 48, Canning Road, Croydon.

Octron.—No. 473,186. All goods in class 8.—H.S. Electric, Ltd., 32, Charlotte Street, Birmingham.

Published Specifications.

Compiled expressly for this journal by patent agents. The name of the applicant's patent agent, if any, will be found on the printed specification. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

8,070. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin and L. Polinkowsky). March 25th, 1925. (258,741.)

13,686. "Electric lighting apparatus for motor vehicles." H. C. Procter and J. Starkie. May 26th, 1925. (258,914.)

13,782. "Transformers, choke coils, and the like for use in telegraphy and telephony." N. H. Clough. May 26th, 1925. (Cognate application 5,256/26.) (258,915.)

13,919. "Electric machines with slot windings." Siemens-Schuckertwerke Ges. May 28th, 1924. (234,821.)

16,396. "Radio receiving apparatus." J. Sieger and J. Cornrich. June 25th, 1925. (258,927.)

16,598. "Adjusting devices suitable for radio apparatus and the like." W. Ritscher. June 27th, 1925. (258,930.)

16,630. "Method and apparatus for utilising public or household electric supply current for operating wireless apparatus." S. Iredell. June 29th, 1925. (258,931.)

16,719. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., L. P. Lowry, and C. G. White. June 29th, 1925. (258,934.)

16,810. "Automatic and semi-automatic telephony." Standard Telephones and Cables, Ltd., R. A. Moir, and G. C. Hartley. June 30th, 1925. (258,939.)

16,837. "Directional aerial systems for radio transmission or reception." C. S. Franklin. June 30th, 1925. (258,942.)

16,922. "Electrical devices for the detection and transmission of sound or small movements." W. J. Rickets. July 1st, 1925. (258,946.)

17,127. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin). July 3rd, 1925. (258,956.)

17,212. "Protective apparatus for alternating-current electric circuits." A. Reyrolle & Co., Ltd., and R. W. Biles. July 4th, 1925. (258,961.)

17,215. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., R. A. Moir, and G. C. Hartley. July 4th, 1925. (258,962.)

17,638. "Radio receiving apparatus comprising means for rejecting undesired signals." Igranic Electric Co., Ltd., and P. W. Willans. July 9th, 1925. (258,969.)

17,773. "Method of and means for the magnification of small electric currents." Muirhead & Co., Ltd., and B. Davies. July 10th, 1925. (258,970.)

18,554. "Electrically-heated apparatus for drying, impregnating, or vulcanising." Sir A. W. Brown. July 21st, 1925. (258,977.)

18,933. "Dynamo-electric machines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. July 25th, 1925. (258,981.)

20,529. "Generation of electrical oscillations." W. H. Eccles. August 15th, 1925. (258,989.)

21,556. "Mounts for coils used in wireless apparatus." I. G. F. Harris. August 28th, 1925. (259,001.)

21,861. "Apparatus for radio communication." S. C. Pearce and J. S. Smith. September 1st, 1925. (259,005.)

23,197. "Means for controlling current passing to electro-motors." Smith, Major & Stevens, Ltd., and P. H. Stevens. September 17th, 1925. (259,014.)

24,764. "Electrical indicating mechanism, more particularly for use with flow meters." British Thomson-Houston Co., Ltd. October 7th, 1924. (241,191.)

27,221. "Electric switches." National Carbon Co., Inc. February 12th, 1925. (247,518.)

27,358. "Measurement of high electrical resistances and/or the capacity of condensers, or other values which are functions of resistance or capacity." J. D. Inglis. October 31st, 1925. (259,048.)

28,157. "Electric amplifying systems." British Thomson-Houston Co., Ltd. November 10th, 1924. (242,667.)

30,330. "Type-printing telegraphs." Etablissements E. Belin. December 17th, 1924. (244,742.)

32,035. "Method for the measurement of alternating voltages." General Electric Co., Ltd., and J. Farnsworth. December 18th, 1925. (259,071.)

1926.

771. "Methods of forming commutators." Deutsche Gasglühlicht-Auer Ges. January 10th, 1925. (245,798.)

1,357. "Variable condensers." E. R. Stevenson. January 18th, 1926. (259,082.)

2,435. "Multiple fuse plug." E. C. R. Marks (Boehm-Hennes & Co.). January 27th, 1926. (259,089.)

3,699. "Electrical means for controlling lifts and the like." Etablissements Vernes, Guinet, Sigros & Cie. December 3rd, 1925. (259,096.)

3,820. "Magneto." J. E. Perisset. August 10th, 1925. (Divided application on 256,054.) (259,097.)

4,309. "Electrolytes for electrical batteries." G. A. Howland. February 11th, 1926. (259,099.)

5,519. "Sound-reproducing apparatus." P. S. O'Donnell. September 30th, 1925. (Divided application on 256,677.) (259,103.)

5,667. "Means for adjusting electric-light pendants." A. Tullett. March 1st, 1926. (259,104.)

5,710. "Lighting apparatus for advertising and like purposes." X. Waller and A. Schilter. March 1st, 1926. (259,105.)

6,831. "Electrically-driven winches." Sunderland Forge and Engineering Co., Ltd., and W. B. Marr. March 11th, 1926. (259,114.)

7,668. "Process for the electrolytic separation of metallic chromium." R. Appel. November 26th, 1925. (259,118.)

8,509. "Starting devices for internal-combustion engines." H. E. Jodor. March 29th, 1926. (259,123.)

9,414. "Electrical condensers." D. M. Macdonald and Dubilier Condenser Co. (1925), Ltd. April 9th, 1926. (259,131.)

10,670. "Combined valve-holder and grid-condenser for wireless valves." H. Ingham. April 23rd, 1926. (259,134.)

12,279. "Regenerative systems of electric traction." International General Electric Co., Inc. May 28th, 1925. (252,699.)

12,389. "Electric head-lights." G. P. M. Herion. May 13th, 1925. (Addition to 245,433.) (259,141.)

13,054. "Regenerative braking system particularly for direct-current operated electric railway vehicles." Maschinenfabrik Oerlikon. February 25th, 1926. (259,144.)

16,231. "Electric rolling-mill drives with Ward-Leonard control." International General Electric Co., Inc. June 30th, 1925. (254,714.)

19,378. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. August 5th, 1925. (256,627.)